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CERAMIC ABSTRACTS

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Compiled by the

AMERICAN CERAMIC SOCIETY

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Abrasives

PATENTS

Process of producing carbides of sodium and boron. CHARLES E. PARSONS. U. S. 1,473,510, Nov. 6. The process of simultaneously producing sodium carbide and boron carbide from sodium tetraborate, which consists in melting said borate out of contact with the air; raising the temp. to a point between 1000°C and the point of dissocn. of said borate; adding sufficient carbon to produce the desired sodium and boron carbides; and recovering said carbides.

Alumina. A. L. PEDEMONTE. Brit. 195,295, May 5, 1922. Pure Al_2O_3 is obtained from ferruginous bauxite by heating in a reducing atm. to render the Fe and Ti magnetic, sepg. these impurities by magnetic action, dissolving the purified bauxite in HCl or H_2SO_4, digesting to render SiO_2 and any remaining Ti insol., filtering, and evapg. the filtrate to dryness and calcining the Al salt to obtain Al_2O_3 and recover the acid. (*C. A.*)

Art

Intimate discussion of American china ware. ANON. *Ceramist*, **3**, 38–47(1923).—Foreign porcelain wares are considered as belonging to 2 groups: the porcelain of Limoges (French china) which has a hard feldspar glaze, and English bone china, having a softer glaze. French ware lends itself best to delicate underglaze treatment. Brilliant colors are not often seen and overglaze decorations do not fuse well into the hard glaze. The English china is the supreme ware for rich coloring. Broad bands ground-laid over the glaze and fired hard form a distinctive treatment that is exclusive. All the English overglaze colors are brilliant because the soft glaze assimilates them well. The use of rich gilding is not defended. This method of decoration belongs to the 18th century. It was brought to perfection under the kings of France in probably the most debased period of art in history. The following are cited as examples of epoch making departures in the artistic treatment of ceramic wares: the ivory finish of Royal Worcester wares, 1880–95; Rookwood matt glaze in 1890; Copenhagen overglaze painting, 1893 and Rookwood vellum, 1903. American potters will not undertake the manuf. of hard porcelain, because it will require the adoption of methods radically different from those in present use. The manuf. of English or bone china is the alternative. The following suggestions are made relative to the manuf. of this ware. Cone 10 is better than cone 9 for the biscuit fire. The glaze should not be fired above cone 4; the body will have to be adjusted to the use of feldspar instead of Cornwall stone; the Dillsboro North Carolina kaolin can be used if available of uniform quality. Close attention to the grinding of a body is imperative. The best ware cannot be made on high speed plan. Placing of the bisque and the ware is a special problem which will require careful attention. Decoration of ware should be in charge of a skilful designer who is not bound down by traditions of the past. Seconds ware should not be sold in competition

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with the best. Attention is called to the keen interest which is being displayed in the study of pottery and porcelain by women's clubs. C. W. P.

Casein colors and paints. MAURICE DE KEGHEL. *Rev. prod. chim.*, **26**, 469–72, 501–6(1923).—A description of the prepn., properties and uses of water colors having a casein binder, casein paints (for art work), and casein varnishes. A. P.-C. (*C. A.*)

Cement, Lime and Plaster

Artificial cement plants at Marcoing (France). AVRAM J. LUSTMAN. *Rev. Mat. Constr. Trav. Pub.*, **166**, 157–9(1923).—Description with 10 figures of plants of "Société Anonyme des Ciments Artificiels de Cambrésis" started in 1921, with a capacity of 400 tons of artificial cement in 24 hours. L. N.

Slag brick manufacture. ANON. *Rev. Mat. Constr. Trav. Pub.*, **168**, 206–9 (1923). L. N.

Carbonating lime at dull red heat. GERMAIN MOUSTIER. *Rev. Mat. Constr. Trav. Pub.*, **168**, 198–9(1923).—*Hydrated Lime* having the following per cent chem. compn., $SiO_2 + Al_2O_3 + Fe_2O_3$ 1.5, CO_2 0.8, combined H_2O 20.7, total CaO 74.3, MgO 0.6, unanalyzed 2.1, was heated at a dull red heat in a small muffle fur. with a kerosene lamp. After $1^1/_4$ hr. of heating, 150 gm. of lime were found to have been carbonated to the extent of 9.4% of the total CaO. In a series of expts. 0.703 gms. of *quicklime* were heated in a covered platinum crucible to a dull red ht. with an alcohol vapor burner, carbonating of the lime being after 2.3 hrs. of htg. 19.2%, 6.3 hrs. 80.0%, 8.3 hrs. 84%, 10.3 hrs. 85%. The importance of the presence of gases of combustion in the cooling region of kilns is emphasized. L. N.

Resistance of "Vassy" cement mortars to the action of selenitic waters. R. M. *Rev. Mat. Constr. Trav. Pub.*, **168**, 199–202(1923).—A general historic review of French literature relating to the experiments on the natural cement of Vassy, which withstands the destructive action of sea water, and water charged with alk. earth sulphates. (With photographs of testpieces after long exposures.) L. N.

The gypsum industry. A. BRITTAIN AND C. ELLIOTT. *Trans. Ceram. Soc.* (Eng.), **22** [1], 44 (1922–23).—A paper on the consideration of the general methods employed for the conversion of the mineral into its manufd. products and testing of these products. H. F. S.

Fused cement. ANON. *Quarry & Surveyor & Contractors' Jour.*, **28**, 293(1923).—Fused cement tests have revealed that in the Hennibique system a higher coeff. of safety for concrete under the usual stresses is procurable than can be obtained with Port. cement. For concrete beams, the deflections before rupture with fused cement in the mix were always stronger than with Port. cement. Fused cement, however, is not very binding, consequently great care must be observed in pounding, releasing the molds, etc. In the mix, too much sand is better than not enough, and the best propn. of water is 150 l. per 800 l. of gravel and 400 l. of sand; the materials should be mixed till of a plastic consistency. All surplus water should be thoroughly drained off in every opern. O. P. R. O.

Proper handling of lump lime. ANON. *Contract Rec. and Eng. Rev.*, **37**, 1071 (1923).—When using a quick-slaking lime, if insufficient water is added, the paste is not as plastic and works short. It feels slightly gritty, and has a yellowish tinge. The temp. of the mass is raised considerably above b. p., and a new chem. reaction takes place. This results in a formation of a subs. which absorbs carbon dioxide at a rapid rate, and thus hardens before it may be used. Exactly what this new compd. is, has not been definitely detd., but the result is well known by those who use lime. In the case of "drowned" lime, the excess of water has absorbed too rapidly the ht. for slaking, and the change from quicklime to paste is retarded. When the paste is formed it is thin

and watery and unsatisfactory. A good lime putty, properly prepd. and allowed to age or soak for some time previous to its use, makes a mortar or plaster that is easily applied; aging the paste imparts to it a degree of smoothness not otherwise obtained.

O. P. R. O.

Adhesive for mother-of-pearl, horn and wood. ANON. *Oil & Color Trade Jour.*, **64,** 1444(1923).—An excellent cement can be prepd. by mixing glue, suitably diluted, with a corresponding quantity of strong warm vinegar, adding a certain amt. of ordinary alcohol with a little alum. The cement thus obtained possesses a very great cohesive power, and will keep perfectly fresh in well stoppered bottles. The following process may also be observed: For natural woods, make a cement with a basis of sawdust and glue. For mother-of-pearl and horn, use a cement based on powdered zinc white and floor varnish. O. P. R. O.

Potash and waste heat recovery from cement kilns. ANON. *Chem. Age,* **9,** 442(1923).—A new method of effecting recovery of potash from dust of cement kilns (an English invention) is described. This process presents possibilities in the way of utilizing waste ht. for steam-raising purposes. Expts. have shown that with certain grades of raw mat. some of the dust from the kilns will collect in caked form on hot surfaces. This mat. contains potash salts and other ingredients which make it valuable and may be sold at a higher price than the finished cement. The part of the dust adhering or caking to the hot surfaces has a different chem. compn. from the rest of the dust which will not so adhere, making possible the recovery of the valuable by-product. The mat. is removed from the walls by means of scrapers; from the primary collecting flue hot gases are led through a ht.-absorbing device in the shape of a waste-ht. boiler. Here a considerable reduction in temp. of the gases is effected; their vol. and velocity are likewise reduced and sepn. of the remainder of the dust is facilitated. Because of the cooling of the gases in this way the dry dust separators beyond the boiler have gases of less velocity to handle; the washers through which the gases subsequently pass, operate much more satisfactorily on the cooled gases, as very hot gases tend to evap. and carry away the spray water in the form of steam, and interfere with the satisfactory opern. of the washer generally. The cooled gases are also more readily handled by the fan. In cases where the final removal of the dust is effected by elec. means, the reduction in temp. of the gases is of advantage. O. P. R. O.

Cement from blast furnace slags. ANON. *Quarry & Surveyor & Contractors' Jour.*, **28,** 294(1923).—Recent expts. show that Port. cement may be manufd. from acid blast fur. slags by the addition of certain missing oxides (lime and alumina) to the liquid slag. The best practice is first to add the alumina, then the lime, and thus obtain a very fluid melt, which easily takes up lime. The m. p. remains low for a long time, but the process appears difficult to carry out on account of the high temp. necessary. O. P. R. O.

The French "fused cement (electric)." NITZSCHE. *Zement,* **12,** 142–3(1923).—A tabulation and comparison of the analytical results and phys. properties of "fused cement" obtained by different investigators. R. F. S. (*C. A.*)

Simple cement tests. A. T. FRY. *Commonwealth Eng.*, **10,** 442–5(1923).—In the absence of a testing machine, make test bars 1 x 1 x 10 in. Support them at the ends and apply the load by means of a special hook at the center of the bar. A bucket is suspended from the hook and lead or shot used for loading the bucket. The corresponding tensile strength may then be calcd. from the load and span of the bar.

R. F. S. (*C. A.*)

Relations between volume and strength. H. KÜHL. *Zement,* **12,** 236–7(1923).—The present available data on Portland cement do not permit any relationships to be drawn between the vol. and strength of the cement. R. F. S. (*C. A.*)

Do slags rich in lime give fused cements? C. PRUSSING. *Zement,* **12,** 255–9

(1923).—Mixt. of the ternary system SiO_2–CaO–Al_2O_3, which were all rich in CaO, were studied. The CaO content of slags cannot be increased above 51% without decreasing the hydraulic properties. Cryst. systems below 60% CaO show weak hydraulic properties. R. F. S. (*C. A.*)

PATENTS

Waterproof concrete. A. G. Lindén. Swed. 52,563, Aug. 23, 1922. A mixt. of 70–30 parts of cement and 30–70 parts of pulverized brick or talc. (*C. A.*)

Acid-proof mortar. E. S. Qvidinger. Swed. 52,765, Sept. 20, 1922. An intimate mixt. of cement with finely pulverized chamotte and alum-slate is stirred with a suitable quantity of a soln. of alkali silicate of convenient concn. (*C. A.*)

Treating slag bricks. Aktiebolaget Arcus Betongindustrie. Swed. 53,126, Nov. 29, 1922. The freshly formed bricks are subjected to steam or steam jets to bring about a preliminary binding before the hardening in the air. (*C. A.*)

Cements. H. Kontzler. Brit. 193,372, Aug. 1, 1922. Slow-setting cements are produced by the fine pulverization of an intimate mixt. of gypsum with aluminates, hydroxides of Al_2O_3 such as bauxite, or natural or artificial pozzuolanas, *e. g.*, blast furnace slag. In the case of a slag contg. less than 30% of SiO_2 and more than 10% of Al_2O_3, 16–20% of gypsum, previously dried at 80°, is used. (*C. A.*)

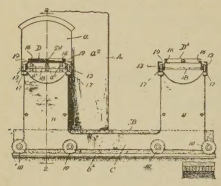
Cements. A. F. Mueller. Brit. 197,702, May 15, 1923. A hydraulic cement consists of a finely divided mixt. of foundry slag with ferruginous, siliceous, and alumina-, lime-, and magnesia-contg. ingredients in proportions depending upon the compn. of the slag, and with or without clinkers from furnace residues. Clinkers are preferably used which have been freed from coke, etc., by the process described in 146,238, and have thereby become coated with clay, chalk, gypsum, or carbide sludge. Suitable ferruginous addns. are bog ore, Permian limestone, brown ore, Porta stone, ferruginous sandstones, aluminous siderite, slate, ferruginous earths from Paleozoic and Permian formations, finely divided Fe, waste sand dust and sludge from the grinding and polishing of Fe castings, and waste molding sand. Al_2O_3 is furnished by ferruginous clay. MgO is preferably added in the form of mica sand. Suitable calcareous subs. are slaked lime, lime-kiln waste, gypsum dust, and carbide sludge. Artificial stones are obtained by mixing 15 to 25 pts. of the cement with 100 pts. of granulated clinker, breeze, or slag, with or without other filling materials such as sand, pebbles, ground wood, etc. A small amt. of an alkali salt, such as Na_2CO_3, may be added to accelerate setting and increase strength. (*C. A.*)

Enamels

Types of iron and steel which do not rust or ignite. K. Daeves. *Prazision*, **1**, 270–1; *Physik. Ber.*, **3**, 667–8.—The difficulties encountered in working non-corrodible, high-Cr steels are lessened by reducing the C content and by corresponding heat treatment. Ordinary rust-proof steel consists of about 13% Cr, 0.5% Ni, and 0.7 to 1.0% C. After hardening it has a rigidity of 110 to 170 kg./mm.^{3}, which is not affected by heating to 500°. The coeff. of expansion is 11×10^{-6}. Both heat and elec. condy. are less than that for C steel. Cold work decreases resistance to rusting. Resist. to HCl and H_2SO_4 is not perfect but atm. oxidation does not take place even at 900°. Where special hardness is not required a steel of 13% Cr and 0.1% C is recommended. These steels may be cast, forged, stamped, machined, etc. For surgical or dental instruments a higher Ni content is recommended. All these steels are useful for phys. or chem. app. used at high temps. Their cost is about 10–12 times that of ordinary steel. A. E. S. (*C. A.*)

PATENTS

Charging fork for enameling furnaces. WILLIAM HOGENSON. U. S. 1,471,028, Oct. 16. Charging means for enameling fur. comprising a traveling, wheeled carriage, two widely spaced sets of track bars secured on said carriage, and two fork frames mounted on rollers that travel on said track bars, each fork being movable independent of the other, and there being free and unobstructed loading and unloading passages between said sets of track bars, and between said fork frames, whereby either fork frame may be loaded and unloaded from either side.



Method of cementation of boron into the surface of iron or steel. TAKEO MIYAGUCHI. U. S. 1,472,850, Nov. 6. A method of cementation of boron into the surface of iron or steel comprising covering the desired surface of the iron or steel with a mixt. of carbon powder and boron oxide or compd., and heating it at from 800°C to 900°C in a reducing atm. Brit. Pat. 193,917, Nov. 3, 1921.

Method of cementation of boron into the surface of iron or steel. TAKEO MIYAGUCHI. U. S. 1,472,851, Nov. 6. A method for the cementation of boron into the surface of iron or steel, comprising placing the iron or steel within a closed fur., covering the portion desired to be cemented with a finely powdered boron contg. mat., shielding the remaining portion with iron plate, iron powder, clay or the like to prevent cementation action of boron, and heating the iron or steel for a considerable period, at from 800–900°C in the presence of chlorine gas. Brit. Patent 193,918, Nov. 3, 1921.

Enamels. CHEMISCHE WERKE VORM. AUERGES. Brit. 197,933, May 10, 1923. To prevent opaque enamel from bubbling during firing, a portion of the clay which is usually added to the mill is first made incandescent and then added to the other ingredients. One-half of the clay may be so treated, and the process is stated to be particularly applicable when Zr or Ce oxide is present. (*C. A.*)

Glass

Table of Belgian patents in the glass industry. J. GEVERS AND CO. (Antwerp). *Le Verre*, **3**, 200–1(1923).—The "Dictionary of Patents" listing the number of patents granted in Belgium from 1830 to the end of 1922 contains a list of patents relating to the glass indus. The table contains 2847 patents subdivided according to 62 classifications: as "fusion of glass" 182 patents, "reinforced glass" 19, "optical glass" 1, etc. About $^1/_3$ of these patents are of Belgian origin, the remainder of foreign origin, especially Amer., Eng., French and Ger. L. N.

Furnaces for melting glass. H. MAURACH. *Glass Worker*, **43** [1], 11(1923); (from *Fuels and Fur.*, Aug., 1923).—The Ger. Advisory bureau report of 1921–1922 on tanks and pot fur. In older fur. the depth of the bath is 27.6 in. Newer practice is 43.3 to 47.2 in. deep. 59.4 in. is the max. Low flat roofs are now used. For a span of 21.3 ft. the rise of the arch is 29.5 in. The distance from the crown to the bath is 5.2 ft. The arch is 10 to 14 in. thick. 4 to 6 inches of glass can be melted and taken out every 24 hrs. Gas ports are discussed and a table of dimensions given for the size of ports for various sizes of pot and tank fur. Sketches of fur. design are given. There should be 2.6 to 4 cu. ft. of checker work per cu. ft. of fur. vol. for tanks. Pot furnaces require two times these values. R. J. M.

Gas producer practice. W. B. CHAPMAN. *Glass Worker*, **42**, 39, 11(1923).—The ht. balance on a gas producer, with the method of calcn., is given in detail. R. J. M.

The manufacture of optical glass. C. J. PEDDLE. *Trans. Opt. Soc.* (London), **23**, 103(1922).—This paper describes briefly the history of optical glass manuf. from the

earliest attempts to date. The present methods of manuf. in Great Britain are then described in more detail. Only 50% of the glass usually passes the preliminary inspection and if 20% of the total is usable after finishing, the melt is considered satisfactory. The yield is often under 10%. "The only sure method of testing for fine striae in glass

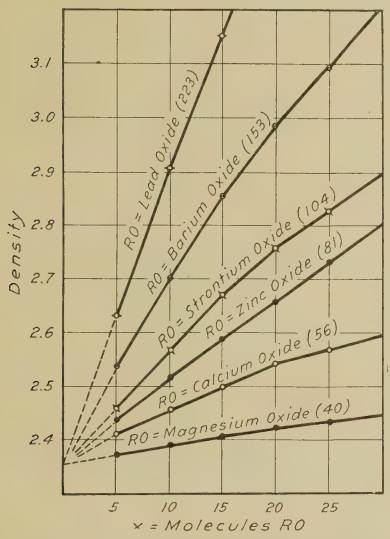


FIG. 1.—Molecular composition and density in the series 100 mols. SiO_2 . 20 Na_2O . xRO.

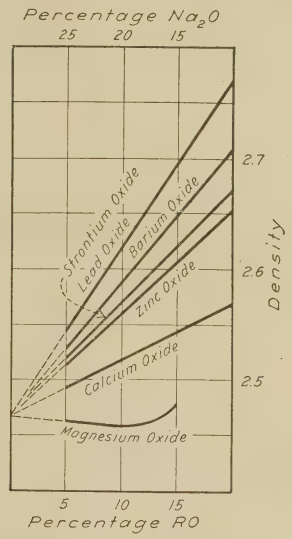


FIG. 2.—Percentage composition and density. (Silica constant = 70%.)

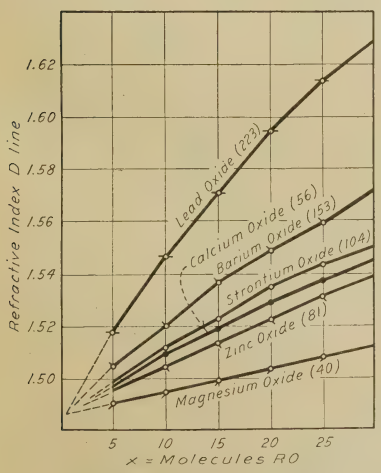


FIG. 3.—Molecular composition and refractive index (μ_D) in the series 100 mols. SiO_2 . 20Na_2O . xRO.

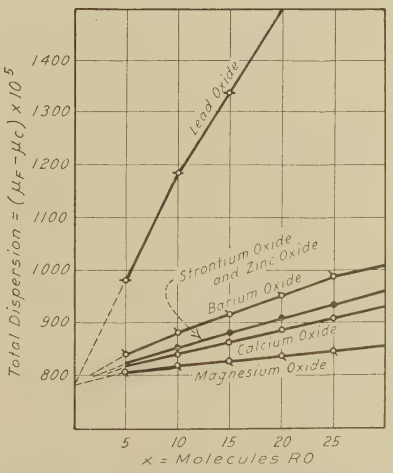


FIG. 4.—Molecular composition and total dispersion in the series 100 mols. SiO_2 . 20 Na_2O . xRO.

is the examn. of pieces of glass, polished on opposite faces, by means of a polariscope." The author has studied the influence of compn. upon density, refractive index, durability and tendency to devitrification (cf. *C. A.*, **14,** 2536; **14,** 2509; **15,** 2966; **16,** 620; **16,** 3180), and these are discussed. The effect of diff. oxides on the d. of glass depends on the mol. wt. of the oxides. In glasses of compn. 100 SiO_2 .20 Na_2O .10 RO the densities and mol.

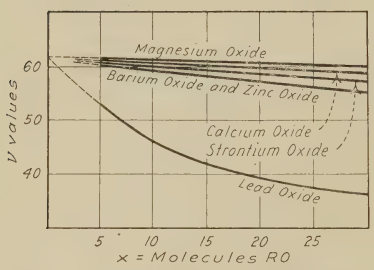


FIG. 5.—Molecular composition and ν value in the series 100 mols. SiO_2 . 20 Na_2O . xRO.

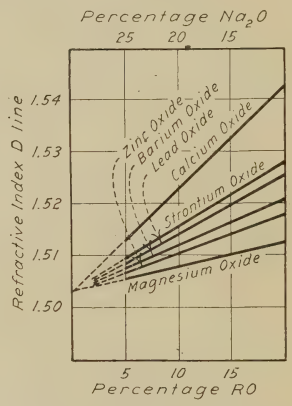


FIG. 6.—Percentage composition and refractive index. (Silica constant = 70%.)

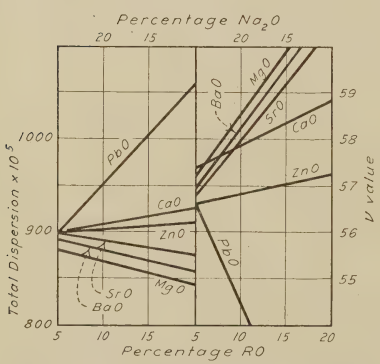


FIG. 7.—Percentage composition and total dispersion. (Silica constant = 70%).

FIG. 8.—Percentage composition and ν value. (Silica constant = 70%.)

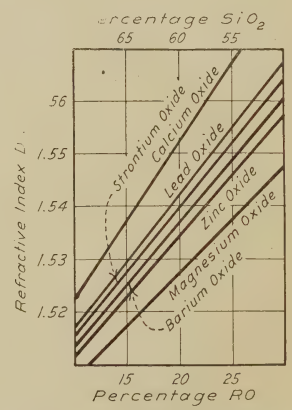


FIG. 9.—Percentage composition and refractive index. (Sodium oxide constant = 20%.)

wts. are in the following order: RO = PbO (223), BaO (153), SrO (104), ZnO (81), CaO (56), MgO (40), densities of glasses are 2.91, 2.71, 2.57, 2.52, 2.46, and 2.39, respectively. The curves illus. the connection between the phys. properties and chem. compn. of glasses. Durability of the glasses was tested by the action of water at 80°C on the

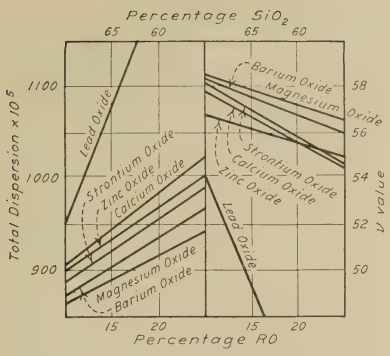


FIG. 10.—Percentage composition and total dispersion. (Sodium oxide constant = 20%.)

FIG. 11.—Percentage composition and ν value. (Sodium oxide constant = 20%.)

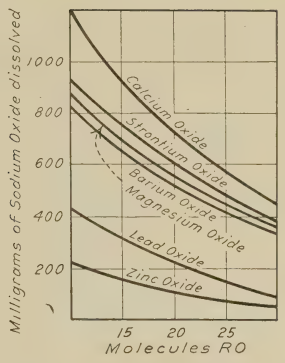


FIG. 12.—Molecular composition and solubility of glasses. 100 SiO_2 . 20 Na_2O . xRO.

powdered glass. ZnO has the greatest effect on improvement of durability when replacing SiO_2 or R_2O wt. for wt. The RO oxides improve durability in order of their mol. wt., MgO being best and PbO worst. Photographs are given of crystals formed in the devitrification of glasses. The paper includes a short bibliography of modern papers on optical glass. *Ceram. Abs.*, **1** [4], 111 (1922); **1** [6], 165–6(1922). D. E. S.

Preheating glass batch. A. FERGUSON. *Glass Worker*, **42**, 39, 15(1923); (from *Pottery Gaz. and Glass Trade Rev.*).—The batch, ground to 60 mesh and preheated to 850°C to free it from CO_2, is introduced into the tank at the rate of 2 lbs. per sec. Waste ht. is used for prehtg. R. J. M.

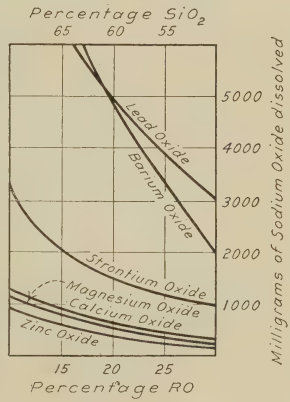


FIG. 13.—Percentage composition and solubility. Sodium oxide constant = 20%.

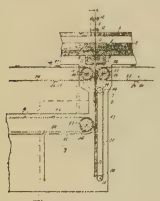
Specifications for glazing glass. ANON. *Glass Worker*, **43** [4], 9(1923).—Specif. are published by the Bureau of Standards, assisted by the manufacturers, covering plate, window, processed, rolled figured, wire, ornamental and prism glass. Nomenclature and definitions are also given. R. J. M.

Continuous sheet glass machine. ANON. *Glass Worker*, **43** [5], 9(1923).—A new flow device produces flat sheet glass of any thickness. A continuous sheet 365 ft. long and 40 in. wide goes through the leer. Installation at the plant of the Licking Window Glass Co. is described. R. J. M.

PATENTS

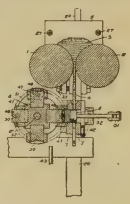
Method and apparatus for forming sheet glass. HUBERT A. MYERS. U. S. 1,471,189, Oct. 16. In an app. for forming sheet glass, a tank for containing molten glass from which glass may flow continuously in sheet form, means for successively feeding end strips in pairs to the opposite edges of the sheet being formed lengthwise of the movement thereof in adherence therewith, means for successively applying upper and lower sets of cross bars to the upper and lower ends of each pair of edge strips and

to the sheet to coöperate with the edge strips to embrace a predetd. sheet area, means for guiding the vertical movements of the frame sheet section and adapted to release the upper and lower ends of each frame for horizontal movement when it has reached a predetd. point in its vertical movement, and means for engaging and moving each frame section laterally from the guide means when in side delivery position and to effect a severing of the sheet between the upper end of the laterally moving section and the lower end of a succeeding section.

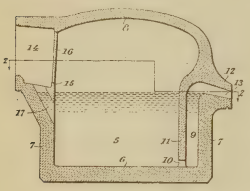


Paste for etching glass. LEO SIMON. U. S. 1,470,772, Oct. 16. A paste for etching glass, containing ammonium sulphate, hydrofluoric acid and a liquid mucilage.

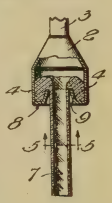
Process and apparatus for producing spectacle blanks. FREDERICK GELSTHARP. U. S. 1,471,725, Oct. 23. Apparatus for producing glass articles, means for generating a sheet of glass continuously in a downward direction, a plunger mounted beneath said means for movement transversely through the sheet, and a drum mounted for rotation in opposition to the plunger and provided in its periphery with a series of mold recesses adapted to be brought successively into alignment with said plunger to receive the articles, means for continuously operg. the rolls and means for intermittently operg. the plunger and drum.



Glass-melting pot. CLINTON A. BOWEN. U. S. 1,471,824, Oct. 23. A glass-melting pot composed of a body closed at the top and having a mouth near the top thereof and projecting therefrom, said mouth being provided with a door, and an opening formed in the bottom of said mouth and communicating with said body below said door, said opening being so positioned that molten glass can be fed into the body below the normal working level of the glass therein.



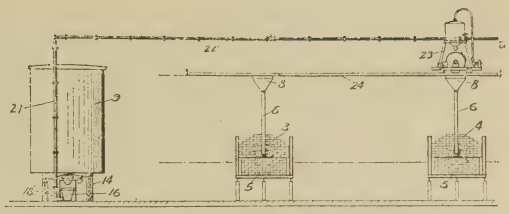
Blowpipe for glass-making apparatus. JOHN CARMANY CAMPBELL. U. S. 1,472,291, Oct. 30. A device of the character described comprising a hollow body open at its lower end, said body having oppositely disposed flat walls positioned close together and connected at their ends, an inwardly extending horizontally disposed flange at the lower end of the walls of said body terminating in an inwardly and upwardly extending lip, and an air pipe extending from the top portion of said body.



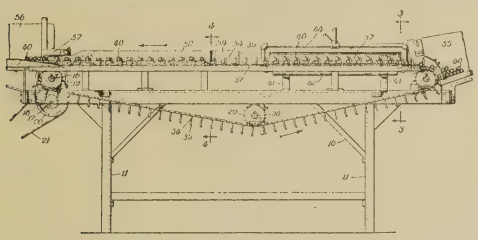
Glass. CHANCE BROS. & CO., LTD. and A. L. FORSTER. Brit. 197,590, April 11, 1922. Relates to glass of the kind in which Fe_2O_3 is combined in the ferrous state to enable the glass to act as a good absorber of thermal radiation. According to the invention, the propn. of Fe_2O_3 is such that the amt. of FeO per unit area of the glass will give the desired absorption and transmission of thermal and luminous radiations. *E. g.*, hammer scale or Fe oxalate is added in such quantity that the finished glass sheet contains about 0.01 g. of FeO per sq. cc. of surface. It is found that with such a glass, the ratio of luminous radiation transmitted to thermal radiation absorbed is a max. and the glass is suitable for window and roofing purposes in hot countries. (*C. A.*)

Raw-material conveyer for feeding glass furnaces. WILBUR F. BROWN. U. S. 1,473,008, Nov. 6. The method of feeding raw mat. from a common source of supply to a plurality of glass melting furnaces, consisting in drawing the several materials by suction through a conduit to the vicinity of any selected furnace, there mixing the materials together, and then delivering the mixed batch directly to the fur. An app. for conveying raw mats. from the storage tanks to a plurality of glass melting fur.,

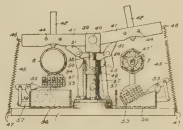
comprising a conduit extending from the storage tanks to the fur., means for feeding the mats. from the tanks to the conduit, means for drawing the mats. through the conduit by suction to any selected fur., and means for there delivering the mats. from the conduit to the fur.



Glazing machine. HANS N. HALVERSEN. U. S. 1,473,675, Nov. 13. In a glazing appliance of the character described, the combination of two htg. means positioned to successively heat the opposite ends of the bodies treated, a guide-plate for each of said heating means, a support having portions sloping in opposite directions toward said guide-plates, and a pair of parallel endless conveyor chains equipped with forwardly bent fingers to engage and roll the inclined bodies to be glazed along said support first with one end against one guide-plate and the opposite end subject to the action of the corresponding heating means, and subsequently with the glazed end against the second guide-plate and the other end in a position to subject it to the action of the second heating means, said support and bent fingers maintaining in each instance the end being glazed in advance of the end bearing against the guide plate substantially as described.



Glass-banding machine. JAMES BOYD GREER. U. S. 1,473,762, Nov. 13. A cutting machine comprising an intermittently rotating chuck adapted to receive the article to be cut, means for actuating the same, a cutter carrying arm mounted adjacent said chuck, a cutter thereon, said cutter arm being pivoted to a supporting head, said head and cutter arm being freely removable from the machine as a unit, and automatic means for moving the cutter into and out of engagement with the said article.



Heavy Clay Products

Brick made from coal bearing schist. G. HERMANT. *Rev. Mat. Constr. Trav. Pub.*, **168,** 209(1923).—Ground schist contg. 4, 6, and 8% carbon was made into brick by the sand-lime brick process with slaked lime in propns. of 4, 6, 8 and 10%. Satisfactory brick were made with schist contg. not more than 6–7% combustible carbon, and with 4–8% lime. The max. crushing strength of 120–130 kg. per sq. cm. was obtained with schist contg. 4% carbon, schist with 6% carbon giving 105 kg. per sq. cm. Porosity ranged between 8 and 11%. L. N.

Brick and tile works ("La Bédaricienne" at Bédarieux (Herault, France)). J. E. D. *Rev. Mat. Constr. Trav. Pub.*, **168,** 161–6B(1923).—Description of plant, with 2 drawings and 4 photos. Two kilns are in service (1) a Hoffmann continuous kiln 43 m. long with chambers 2.60 m., having a coal consumption of 120–130 kg. per 1000 brick (5 x 11 x 22 cm.) with a daily product of 25,000. (2) a semi-continuous kiln 20 m. long, with chambers 3 m., producing 4,000 brick daily with a slightly higher coal consumption than (1). L. N.

Arlington building. LOUIS J. LARSON AND SERGE N. PETRENKO. Bur. Stand.,

Tech. Paper **236.**—The hollow tile and reinforced concrete floors of the Arlington Building, Washington, D. C., were loaded and the deformations measured. This was, at the time, the first test upon this type of construction in which strain-gage meas. were taken. The floor slab was formed by rows of hollow tiles spaced 4 in. in each direction. The reinforcing steel was placed in these spaces and concrete poured around it and into the open ends of the tiles. The columns are steel H-sections surrounded by a thick casing of concrete. The beams and girders have steel I-beams encased in concrete. These beams are generally near the bottom and may be considered the tension reinforcement. The panels, having various ratios of length to width (from 1.05 to 1.86) were loaded with sand bags, separated by aisles to prevent arching, some up to 380 lb./ft.^{2} The loading schedule was intended to produce max. positive and max. negative moments and to enable the study of the effect of transferring load to an adjacent panel The max. stresses developed in the slab were about 27,500 lb./in.^{2} in the negative reinforcement and 24,000 lb./in.^{2} in the positive reinforcement. Both stresses were developed at the load of 335 lb./ft.^{2} The stresses developed in the reinforcing I-beams of the girders were lower. The max. recorded compressive stress in the concrete was about 1,600 lb./in.^{2} The distribution of the cracks in the concrete furnished an indication of the distribution of the stresses at an early stage of the test. The first cracks observed were diagonal ones on the bottom of the slab. They occurred at about the same time as the cracks on the top which extended across the corners and at right angles to those on the bottom. The cracking of the concrete was accompanied by a considerable increase of the stresses in the reinforcing steel. The study of the cracks and the stresses shows that in a test of this kind, the deformations, though measured at positions of max. moment, will fall far short of showing the max. stresses unless the gage lines are located across or very close to the principal cracks. Thus, in some cases, the stresses observed at positions of max. moment and at the gage lines crossed by cracks were 16,000 and 23,000 lb./in.^{2}, while stresses in gage lines 12 in. from the cracks were 4,000 and 5,000 lb./in.^{2}, respectively. The effect of time under load was very pronounced in the first 20 hours and comparatively small later The effect of increasing the ratio of the length to the width of the panel was to increase the moments carried by the positive and the negative reinforcement in the short span and a corresponding decrease of the moments in the long span. The beams offered very little resist. to torsion and the stresses in the negative reinforcement across the beam were little affected by the transfer of load across the beam. The increase of the deformation in the reinforcement due to long continued loading was greater than that in the concrete. This probably was partly due to the assistance of the clay tiles in resist. the compressive deformation because of the clay tiles yielding less than the concrete. The moment coeff. are generally small due to the low stresses and are not proposed for use in design but to show the rel. amt. of bending moment carried in the 2 directions. From the comparison of these results with those obtained from tests of simple beams, it appears that the factor of safety of the construction is the greatest. H. F. S.

Remarkable new brick-making process. ANON. *Times Trade & Eng. Supplement* (London), **13,** 133(1923).—This new process consists in the thorough disintegration and drying of the particles of the mat. as a first opern. The saving of time is obvious, for after 15 min. the dried and finely granulated clay passes to a moistening device wherein a complete stirring, without compression, combined with a projection of fine particles of water, converts the dry clay into a pulverized mass which is perfectly and regularly moistened to the exact deg. required. The amt. is then led into hydraulic presses, and on leaving these a brick placed edgewise is of sufficient strength to support the wt. of 2 men standing upon it. The bricks are then baked, 80% being suitable for facing bricks. *Time:* One series of machinery can produce from

3,500 to 4,800 bricks per hour. *Labor:* The labor needed in the new process as compared with the old-fashioned wet process is as 7:22. *Cost:* The comparison of the approx. cost per thousand is as 13:21. The finished product has 50% more resist. to press., frost, and chipping. In matter or economy, this is a process by which brick and tile may be made, superior in quality, at a cheaper rate, with less labor and time; it is possible to make brick and tile from mats. which have hitherto been considered useless for such manuf. O. P. R. O.

New invention for bricklaying machinery. ANON. *Times Trade & Eng. Supplement* (London), **14,** 9(1923).—This new bricklaying mach. is in opern. on a large housing scheme in Glasgow. The average number of bricks laid per hr. is 1,300, as compared with the bricklayer's av., 800 per day. The mach. is known as the K erector, and consists of a traveling rail, by means of which the portion designed to lay bricks is enabled to travel in 2 directions, at right angles to one another. By this means a circuit of the outside walls is made, the mach. laying the bricks as it goes. A special device checks the opern. at door and window openings, and the internal walls are erected in the same manner as the outer walls. The laying wheel rotates, taking 2 bricks at a time from the hopper, the mortar measg. wheels spread the mortar, and the carriage moves along the overhead traveling rail, thus laying a row of bricks as it goes.

O. P. R. O.

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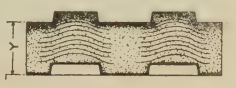
Clay-working machinery. ROY H. MCELROY. U. S. 1,471,405, Oct. 23. The combination with a motor, of a shaft, belting connecting the motor and shaft, a pinion on said shaft, a second shaft, a gear on the second shaft, meshing with said pinion, an extrusion auger carried by the second shaft, an impeller positioned laterally of the auger and adjacent thereto, and means to drive the impeller from the second shaft.

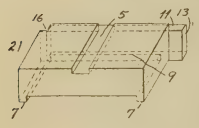
Method of forming interlocking bricks. JOHN T. ROBERTS and JESSE C. MARTIN, JR. U. S. 1,471,506, Oct. 23. The method of forming plastic clay into bricks with bosses and recesses, which bricks when laid with the bosses in the recesses form interlocking wall, consisting in taking a cut block of plastic clay of the same size that would normally form a pressed brick without bosses and recesses, and subjecting the block to press. in such manner that recesses are formed on one face of the block deeper than the height of the bosses on the opposite face by the displacement of clay from the recess side to the boss side of the block.



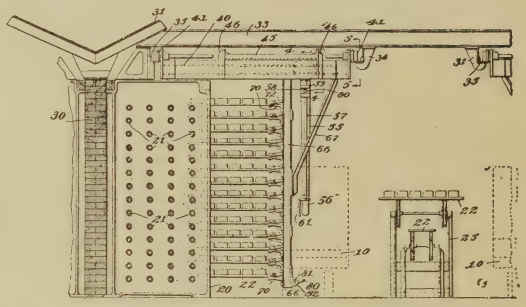
Process for applying vitreous and waterproofing coating to brick and burnt-clay articles. JOSEPH H. HINES. U. S. 1,471,792, Oct. 23. A process for applying vitreous and water-proofing coating to certain of the surfaces of burnt clay articles, consisting in first coating the surfaces of the articles which are not to be coated with the vitreous and water-proofing coating, with clay or kaolin, then baking the articles in a fur. to approx. a red ht. then withdrawing the articles from the fur., then sprinkling powdered vitreous and water-proofing compd. upon the surfaces of the articles which are not coated with the clay or kaolin, and allowing the ht. of the articles to melt or fuse the powdered vitreous and water-proofing compound and permit it to spread over and adhere to the surfaces of the articles which are not coated with the clay or kaolin, then allowing the articles to cool, and finally removing the clay or kaolin from the same.

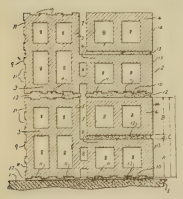
Interlocking building brick. JAMES HUNDLEY. U. S. 1,472,911, Nov. 6. A bldg. brick formed with a plurality of depending lugs in spaced relation to one another on one horizontal face of said brick, a vertical lug adjacent one end of said brick adjacent the exterior face of the brick, a vertical recess on the opposite end of said brick in alignment with said vertical lug, a transverse recess in the surface opposite said depending lugs and in spaced parallel relation to said depending lugs, a plurality of bonding

recesses on the interior face of the brick, said vertical lug projecting to a greater extent than the depth of said vertical recess, and said depending lugs projecting to a greater extent than the depth of the transverse recess, a longitudinal depending lug in alignment with said vertical lug and connecting one extremity of said first mentioned depending lugs adjacent the exterior face of the brick, a longitudinal recess on the opposite edge of said exterior face so positioned that when a series of said brick are laid together to form a wall the exterior face of said wall will form a continuous smooth surface while the interior face will possess spaced recesses between adjacent bricks, except where said lugs engage said recesses, essentially as and for the purpose described.



Brick-pallet-handling apparatus. GRAFTON E. LUCE. U. S. 1,473,305, Nov. 6. Apparatus of the kind described, comprising a movable support, a plurality of clamps carried by said support, said clamps being spaced approx. equal to the distance between the pallet receiving pipes in a steam pipe drier, and means for moving the clamps to engage and hold a plurality of pallets under substantially equivalent holding tension.





Building tile. CHARLES H. TOFFELMEYER. U. S. 1,475,092, Nov. 13. A wall structure comprising main tiles and a filler tile associated with each main tile, each filler tile situated within a recess in a main tile, the tiles being so formed that the cross-section of each pair of assembled main and filler tiles is rectangular.

Refractories

Refractory materials of the London Basin. HENRY DEWEY. *Trans. Ceram. Soc.* (Eng.), **22** [1], 38(1922–23).—By the London Basin the geologist means that part of the S. E. of England which is practically the same as the Thames Basin. The chalk supplies very little mat. of a refrac. nature. Of the Tertiary beds the Thanet sands supply mats. used in the manuf. of lime-sand bricks, and as casting and molding sands. The most remarkable deposit consists of loamy sand of a greenish grey to white tint and varies in thickness up to 5 ft. Refractory wares, used at many of the London and other gasworks, are made from this material. The principal brick-earths form wide-spread tracts at about 90 ft. and 50 ft., respectively, above sea-level. Most of the large brick fields, which formerly supplied London with its bldg. bricks, were in the alluvial brick-earths. H. F. S.

Effect of salty clay upon refractory materials. L. M. WILSON. *Chem. and Ind.*, **42,** 1009(1923).—In a paper read before the Ceramic Soc. (London), Oct. 4, W. said: After he had investigated the action of ammonium chloride, which is found in coke-oven gas from salty coal, he concluded that: (1) There is a critical temp. at about 900°C, at which the chem. properties of burned fire clay seem to undergo a change, quite apart from the critical temps. at which the phys. properties of either raw or fired mats. are known to alter. Below this temp. very little alumina is removed, and above it a great deal of alumina is removed by the action of htd. ammonium chloride. (2) The exptl. evidence demonstrated the superiority of high-grade silica over fire clay for the lining

of coke ovens as regards resist. to salty coal. (3) At temps. from 700°C to 1200°C and higher, ammonium chloride removes iron and alumina from fire clay and from silica bricks. O. P. R. O.

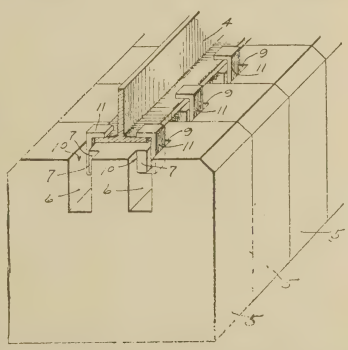
Sillimanite: a high-grade refractory. ANON. *Bull. Imperial Inst.*, **21**, 383(1923).—It is found commonly in gneisses and cryst. schists and in detrital rocks derived from them, usually disseminated in grains or aggregates of fibres. Recently it has been found in India in the massive variety which is very rare. The deposit is in the Khasia Hills of Assam and is in the form of boulders. Experimental work is being carried on by the Imperial Inst. as to its value as a high grade refrac. mat. and if it is successful an attempt will be made to overcome the difficulties of transport and place it on the market. Its valuable properties as a refrac. are strength and toughness, high m. p. (about 1810°C) and stability up to that temp., low coeff. of expansion, low elec. condy., freedom from vol. changes, neutral reaction, and resistivity to corrosive slags and to oxidizing and reducing conditions. Its use is still in the exptl. stage. The Amer. Refrac. Co. in conjunction with the Mellon Institute have also carried out expts. along this line. Though its first cost would be higher than that of less refrac. mats. it is probable that its greater durability will more than compensate for the difference. O. P. R. O.

The importance and future of the German graphite output. E. H. SCHULTZ. *Chem.-Ztg.*, 685(1923); cf. *C. A.*, **17**, 3074.—The Bavarian graphite production increased from 4,000 tons in 1907 to 36,000 tons in 1918, while the Austrian production fell from 50,000 to 32,000 tons, and that of Ceylon from 35,000 to 22,000 tons during the same period. Between 1891 and 1913 German imports rose from 13,000 to 44,000 tons. Because of excellent methods of treatment it is claimed that the local (German) varieties of prepd. graphite are superior to those obtained from other sources, chiefly because they come in flakes rather than in powder form. W. C. E. (*C. A.*)

Refractory materials for the construction of furnaces. THOMAS. *Giesserei-Ztg.*, **10**, 235–7(1923).—Unreliable results are obtained in the detn. of the refrac. quality of a mat. by the Seger cone method, because the stone softens at much lower temps. Far superior is the method of Endell (no reference). The valuation of mats. by this method and their use in fur. construction are discussed. C. C. D. (*C. A.*)

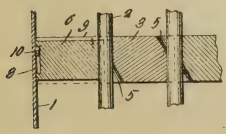
PATENTS

Refractory article. EDWIN B. FORSE. U. S. 1,473,286, Nov. 6. A refrac. article contg. silicon carbide grains having its surface pores filled with finely divided silicon carbide.



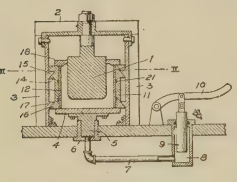
Furnace arch. CLARENCE A. STRACHOTA. U. S. 1,472,945, Nov. 6. The combination with a flanged beam and a block structure in which said blocks are formed with pockets having undercut ledges forming contracted throats of block hangers arranged in opposing pairs and having outer flanges slidable on the beam flange and having inner flanges slidable under the undercut edges of the blocks.

Baffle brick. FRANK H. WAITE. U. S. 1,473,132, Nov. 6. In combination, a pair of walls, a plurality of bars situated between the walls, a plurality of bricks supported between the bars, each brick provided with channels at its ends, said channels being deeper at one of their ends and said deeper portions being diagonally disposed in relation to the bricks, and a plurality of bricks situated between the bars and the walls,



lugs provided on the walls, said latter mentioned bricks each provided with a channel in one end for engaging one of the bars and a bayonet slot in its other end for engaging one of the lugs.

Apparatus for forming clay pots. CLAUDE H. MCCUTCHEON. U. S. 1,473,791, Nov. 13. In combination in apparatus for forming clay pots, a base plate, a plurality of side wall members mounted slidably on the base plate for radial movement, a downwardly extending core in the upper portion of the cavity formed by the side wall members, a framework for holding the core against upward movement, power means for moving the base with the side wall members thereon upward, and coöperating on the means framework and side wall members for causing an inward movement of said members when such side members are moved upward by said base plate.



Refractory compositions. R. SCHAEFER ET CIE AND H. SCHAEFER. Brit. 196,021, Dec. 13(1921). Refractory compns. for making metallurgical or other fur. by molding are prepd. by grinding waste siliceous bricks that have been used in furnaces or quartz that has been heated until crystn. transformation has taken place, and mixing with an organic binder. Suitable propns. are 100 pts. of powder to 5 pts. of binder. Binders specified are non-hygroscopic org. agglutinants sol. in H_2O, such as dextrin, amylaceous materials, albuminoids, glucosides, glucoses, gelatins, and sulfited liquors or residues; and carbonaceous mats. such as resin or asphalt. The compn. is mixed with H_2O, naphtha, or other solvent of the binder, molded, and dried, and is baked *in situ* by lighting the fur. (*C. A.*)

The production of porcelain for electrical insulation. IV. F. H. RIDDLE. *Jour. Amer. Inst. Elec. Eng.*, **42**, 743–7(1923).—Modern methods of prepg. the plastic body are described. The stock of raw materials should be large enough to permit sampling and testing before using. Some ingredients such as ball clays hold water tenaciously, and it is well to store such mat. wet. Hence, in weighing out the batch, it is necessary to det. and allow for the percentage moisture in each ingredient. The old method of blunging, which merely disintegrates the lumps without reduction of size of the particles, is to be avoided. Wet grinding in the ball or pebble mill produces a better porcelain, if properly controlled, but care is necessary, since the quality of pebbles and lining, speed of revolution, total time of grinding, proportioning of volume of clay to volume of pebbles, and the quantity of water all have a decided influence on the resultant grain sizing. After passing the slip over a magnetic separator to remove magnetic iron, it is then passed through a lawn of 120 meshes per in., to eliminate coarse particles, and filter pressed to eliminate excess water, yielding a plastic body of approximately 22% water. The filter press cakes are stacked in a cellar to age. This increases plasticity and provides time for testing mat. before it is released for production. Pugging the filter press cakes after aging distributes the moisture more uniformly, but may lead to trouble, due to lamination (both die and auger). A. F. G.

Whitewares

Manufacture of English chemical porcelain. G. N. WHITE. *Chem. Age* (London), **9**, 334(1923).—W. gives the results of his research in the field of chem. porcelain which is now being produced commercially and successfully. He deals with the scien. basis of the work; the problem of producing a hard porcelain which will carry a hard insol. glaze, will show a high resist. to fracture on sudden temp. change and at the same time be perfectly vitrified and impermeable to gases below 1300°C; also the general ceram. procedure. He deals with chemical porcelain in some detail as to compn., types of

fracture etc., with photographs of body and glazes of Royal Worcester Lab. Porcelain.
O P. R. O.

A study of factors involved in slip-casting. S. R. HIND. *Trans. Ceram. Soc.* (Eng.), **22** [1], 90(1922–23).—The general effect of alterations on the nature (quality) of the casting are: less alkali in the slip; higher slop weight; and lower temp.; all seem to operate in the same direction, *i. e.*, to give a softer, more plastic and thicker casting. H. F. S.

Atmospheric conditions in potters' shops and the efficiency of various types of drying stoves. H. M. VERNON. *Trans. Ceram. Soc.* (Eng.), **22** [1], 70(1922–23).—The high temps. appear to have been due largely to the wishes of the potters themselves. There can be little doubt that they render themselves more susceptible to cold. The very great mortality of potters from phthisis and other respiratory diseases is generally attributed to the inhalation of pottery dust, but it may be due in no small degree to the high temp. and lack of ventilation. The potters' shops investigated were badly underventilated. The humidity of the air in potters' shops is approx. the same as that observed in other shops. H. F. S.

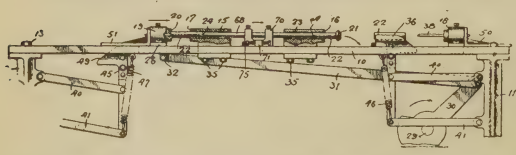
Some experience with the Dorr mill in grinding quartz and flint for pottery purposes. A. S. W. ODELBERG. *Trans. Ceram. Soc.* (Eng.), **22** [1], 1(1922–23).—The mat. is first crushed by means of an ordinary stone breaker fitted with a screen of about 1 cm. mesh, the fragments not passing through being automatically returned to the crusher by means of an automatic conveyor. Ten tons are crushed in about two hours. This crushed mat. is now conveyed to a hopper with a capacity of about 10 T. At the bottom of this hopper is an automatic disk-feeder which can be adjusted to deliver the exact amount required. This continuously feeds the mat. into a trough where it is moistened and intimately mixed with semi-ground mat. returning from the plant. A scoop feeder, fixed on the rotating shaft of the tube mill, gradually works this mixt. into the mill through the hollow shaft by means of a worm. The mill is lined and filled with pebbles in the usual way. At the other end of it there is a hollow shaft, also provided with a worm, which both retains the pebbles and discharges the partly-ground pulp. A strong jet of water pushes this material into what, in the mining industry, is called a launder, which is simply a wooden trough. The pulp, being very much diluted, runs quite freely by gravitation through this trough into the classifier, in which, by means of rakes, the coarsest mat. is returned to the scoop-feeder to repeat the same round, while the finer pulp flows over into a sump, from which it is lifted by a centrifugal pump to the story above into a tank filled to the very top with water. This tank is called a hydro-separator. The coarser pulp runs out at the bottom through an adjustable tap, and it is divided into two parts, one returning to the launder mentioned above, and the other part to the scoop feeder trough to provide the requisite moisture to the material before entering the mill. The finer pulp flows over the brim of the hydro-separator in a fine film and then passes through a 130-mesh lawn to remove any particles of wood or coal dust. The amt. is very small, the lawn requiring to be cleaned only once in 12 hrs. The fine pulp now gravitates through a trough into the middle of what is called the thickener, which is a round tank of 16 ft. diameter and about 10 ft. high, filled to the very brim with water, the top edge being dead level all round. Between this and an outer edge is a groove 3 or 4 in. deep, and of the same width, to collect the overflow. This groove is, at a certain point, connected with a pipe which conducts the overflow of practically pure water to the point where it forms the jet, which forces the pulp coming out of the tube mill into the launder and so to the classifier. Thus the circuit is completed, the same water being used over and over again, apart from what remains in the finished slop mat., which is run off through a tap from the bottom of the thickener and conveyed by gravitation to the flint ark. To replace the water going away with the finished material into the flint ark, a small jet of water from the main runs into the

launder at the discharging end of the tube mill. The rate of grinding at present is about 7.2 T. per 24 hrs. or about 11 lbs. per min., dry wt. The thickness of the pulp as it leaves the tube mill is 1.6 sp. gr. or 32 oz. to the pint. To retain this precise thickness is of the greatest importance, as it makes for the smooth working of the mill. To make it thicker would reduce the output, as the flint pebbles then get clogged in the stiff material, and fail to do their work, the actual grinding then only taking place in contact with the lining. It will not do to dilute the slop mat. in the mill too much, as the pebbles then sink to the bottom, do not mix with the mat. and punish the lining. Should a coarser mat. be required, say particles under 0–01 mm. 52%, particles between 0–01–0.025 mm. 34% and particles from 0.025–0.04 mm. 14%, which is generally used in the potting trade, the output can easily be increased to about 10 T. in 24 hrs. H. F. S.

Continuous grinding. C. J. MOLLER. *Trans. Ceram. Soc.* (Eng.), **22** [1],12(1922–23). —The hard raw mats., flint, feldspar, stone, etc., are first crushed in an ordinary jaw crusher. The preliminary crushing plant runs automatically without any attendance until the bin is empty. From the feeding device the mat. enters a roller mill, crushed to pass mesh No. 10, passes a magnetic separator and a rotary sieve. The hard mats. are weighed out from the different bins in the correct propns. for one charge of the mill, and ground down for about 2 hours with the necessary amt. of water. The soft mats. (clay, china clay, etc.) are filled in, and all the raw mats. are ground together for a quarter of an hr. to $^1/_2$ hr., after which the whole contents of the mill are emptied out as ordinary slip. From the mill the mat. passes over a magnetic separator and a control screen where impurities are retained, and from here we ordinarily run the slip down into big, reinforced concrete hoppers, where it is stored for some time, as it appears that a maturing of the slip takes place when it is kept as a well-ground mixt. for some time in big storage basins. To avoid pptn., the slip is kept agitated from time to time by means of compressed air blown through it. The filter pressing takes place in the foll. way: The slip runs by gravity from the reinforced concrete hoppers down into sheet iron receivers, from which it is forced into the filter presses by means of compressed air. In filter pressing by compressed air, the necessary time is reduced to about half the time ordinarily required for this operation, and at the same time the compn. of the filter press cakes becomes more even, as no blows from a piston reach the slip; and further, the durability of the filter cloths is prolonged, as the blows from filter press pumps seem to have a bad effect on them. H. F. S.

PATENT

Machine for heading porcelain tubes and the like. ALBERT G. MASON and LORENZO C. BUCKLEY. U. S. 1,471,907, Oct. 23. In a tube-heading mach., a stationary die, a movable die coöperating therewith, a feed table adapted to support a tube blank in substantial alignment with said dies, and means associated with the movable die for picking up the blank from said feed table and introducing it into the stationary die, together with means for depressing the feed table and holding it depressed during the working travel of the movable die.



Equipment and Apparatus

Drying refractories or other goods. J. HOLLAND and W. J. GARDNER. *Chem. & Ind.* (London), **42**, 1008(1923).—Improvements in drying refrac. and other goods was subject of a paper read before the Refrac. Mats. Sec., Eng. Ceram Soc., held at

Chester in Oct. This relates to a tunnel drier with traveling racks, with a hot zone 60 ft. long and 3 ft. wide, a longitudinal flue beneath, heated by means of a fur. or by the ht. from waste gases. The flue communicates with two longitudinal lateral flues, one on each side which lead to the chimney stack over the front end of the drier. Continuous with the hot zone is a cooling chamber 10 ft. long. Two parallel steel tracks containing steel rollers extend the whole length from feeding end to delivery end of the drier. As compared with hot-floor drying it is claimed that with this system conditions for workers are better and the goods of higher quality. Much time is saved, and a very much smaller area is required for a given output of silica bricks or other goods. The stove of 2 chambers described can dry 5000 bricks per shift of 9 hrs., using 4 cwt. of coal.
O. P. R. O.

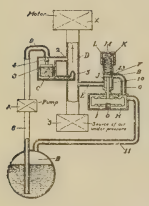
The Proctor drier. A. H. MIDDLETON. *Chem. and Indus.* (London), **42,** 1009 (1923).—The Proctor drier is essentially a close heated chamber, the atm. of which is dry at one end and very humid at the other. The wet goods are thoroughly heated to their core in a very humid atm. before any surface drying can take place. The mach. at Consett is a 3-track tunnel drier consisting of a rectangular chamber 50 ft. long, 20 ft. wide and $6^1/_2$ ft. high, holding cars on each of the 3 tracks, and having a total capacity of 14,976 bricks. If bricks alone were being dried, the drying could be completed in 12 hrs., and probably in 8 hrs. Economical results can be obtained by working the different tracks on different schedules for diff. classes of goods, though of course the best results would attend the drying of one class of goods at a time. Advantages claimed for the Proctor drier, as compared with hot floor, are that drying—especially of difficult shapes—can be carried out much more quickly and with less risk of cracking and setting up drying strains, that the conditions in the molding shop can be made much more healthy and pleasanter for the workers and that a large saving in fuel can be made, excepting when ht. for drying can be provided from exhaust steam or some source that could otherwise be utilized. (Paper read before the Ceramic Soc. of London, Oct. 4.) O. P. R. O.

Metallized electrodes of porous porcelain and the simplest form of the acid alkali cell. K. A. HOFMANN. *Ber.*, **56B,** 1456–63(1923).—Cells have been constructed in which porous porcelain tubes metallized with Pt, Pd, or Ir serve both as a gas electrode and diaphragm. If the metallized porcelain tube is designated as *ptr*, *pdr*, or *irr*, the 2 *N* NaOH as *l*, the 2 *N* H_2SO_4 as *s*, the platinized Pt electrode by *pt*, and the tubes satd. with acid or alkali by *ptrs* and *ptrl*, then the cells' e. m. f.'s are as follows: H_2-*ptrs-l-pt*-H_2, with acid satd. tube dipped in alkali, 0.72 v.; H_2-*ptrl-s-pt*-H_2, with alkali satd. tube dipped in acid, 0.72 v.; O_2-*ptrs-l-pt*-H_2, 1.58 v.; O_2-*pdrs-l-pt*-H_2, 1.55 v.; O_2-*irrs-l-pt*-H_2, 1.74 v.; H_2-*ptrl-s-pt*-O_2, 1.75 v.; H_2-*pdrl-s-pt*-O_2, 1.705 v.; H_2-*irrl-s-pt*-O_2, 1.79 v.; and O_2-*irrl-s-pt*-H_2, 0.32 v. D. MACR. (*C. A.*)

Quartz glass ozonizers. HEBERT FISCHER. *Z. Elektrochem.*, **29,** 318–20(1923).—Under similar standard conditions the O_3 concn. in the quartz ozonizer is considerably less than in a glass ozonizer. The low concn. of O_3 cannot be ascribed to the transparency of quartz to short-wave radiation, for such radiation has not been detected on the outside of the quartz glass ozonizer. Under similar exptl. conditions quartz and glass ozonizers of the same dimensions yield the same O_3 concn. with a Tesla current. Accordingly, the elec. losses in quartz glass have an appreciable influence on the O_3 concn. From this it is concluded that these losses depend largely on the applied frequency. H. J. C. (*C. A.*)

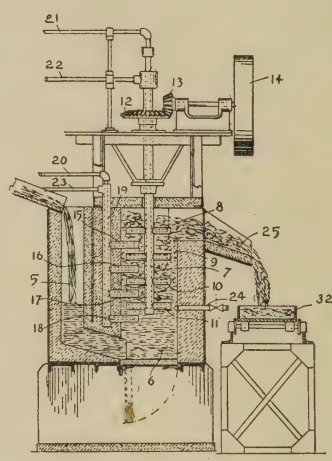
PATENTS

Means to maintain a suitable pressure in the liquid-fuel-storage tanks of airplanes. AUGUSTE CAMILLE EDMOND RATEAU. U. S. 1,471,417, Oct. 23. In a fuel feeding device for a flying mach. propelled by a supercharged motor means to control the press

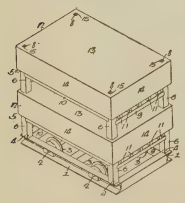


in the fuel tank which consists in reducing the press. of the air under press. delivered to the motor and applying said reduced press. to the fuel tank.

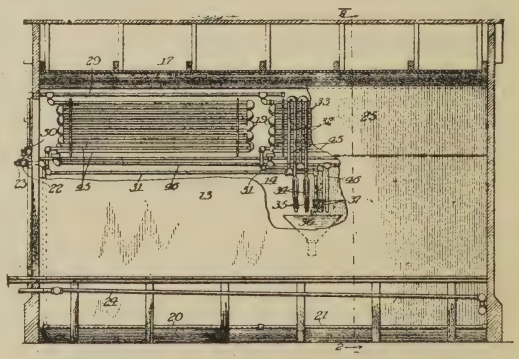
Process of producing porous material. MATHIAS OVROM SEM. U. S. 1,471,421, Oct. 23. The process of producing a porous mat. from molten slag, which comprises continuously leading the molten slag into a container at a temp. of approx. 1400°C, introducing water and a gas therein, subjecting the molten slag and the water to agitation whereby a foam is produced, the introduction of the water being regulated in such manner that the temp. of the foam will be approx. 1000°C, continuously leading the foam into molds and cooling the same to solidification whereby the foam structure is preserved.

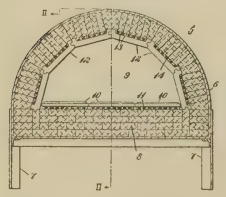


Truck for drying pottery, etc. THOMAS H. RHOADS. U. S. 1,472,676, Oct. 30. The combination of a tray having slats thereon to support the articles to be dried; and a flanged cover extending over the articles and to a point at, or near, the upper surface of the tray, so that heated air, in circulation, will pass up between the slots and the upper portions of the articles will be protected.

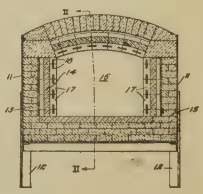


Dry kiln. JOSEPH F. HANRAHAN. U. S. 1,471,602, Oct. 23. In a dry kiln the combination of a drying chamber, a condensing chamber having condensing means therein, heating means and a humidifier, the humidifier arranged between the condensing and heating means, all coöperatively arranged to cause a circulation of air currents from the drying chamber to the condensing chamber, and said humidifier having means for regulating the same.





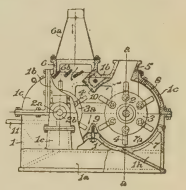
Electric-resistance furnace. THOMAS A. REID. U. S. 1,472,137, Oct. 30. An elec. fur. comprising a plurality of spaced-apart sets of refractory resistor-supporting plates combined to form substantially self-supporting arches, the plates in each set having interfitting tongue-and-groove edges, and directly supporting an elec. resistor.



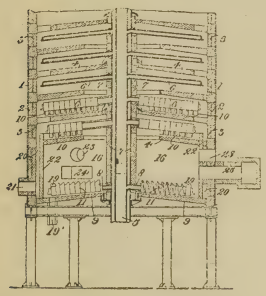
Electric furnace. THOMAS A. REID. U. S. 1,472,139, Oct. 30. In an elec. fur. in combination, a plurality of walls spaced apart to enclose a furnace chamber, a plurality of spaced sets of refractory members of T-shape, having

their narrow ends projecting into said chamber and each having a transversely extending slot in each of 2 opposite faces, and a resistor member extending through said slots and between and beyond said sets of refrac. members.

Pulverizing machine. STANTON C. MARTIN. U. S. 1,472,609, Oct. 30. A pulverizing mach adapted for either fine or coarse work, comprising a double semi-cylindrical casing, parallel rotary hammers in said casing, a mat. inlet pipe leading into one part of the casing, said part having also a discharge outlet, a deflector at the top of the casing between the two parts thereof, and a removable perforated screen over said outlet, through which coarsely pulverized mat. is discharged, the hammers in this case being rotated in opposite directions.



Protecting electrodes passing through fire-brick walls. E. A. A. GROENWALL. Swed. 53,757, Feb. 14, 1923. The electrodes are cooled at those sections that pass through the wall. Extra cooling segments are placed on the wall outside the layer of bricks immediately surrounding the electrodes. (*C. A.*)



Calcining apparatus. ROBERT D. PIKE. U. S. 1,472,935, Nov. 6. A calciner for the described purpose, the same comprising an outer shell, a series of superposed hearths arranged therein in staggered relation, a series of rabble arms associated with and movable over each of said hearths, a rotatable column carrying said arms centrally extended through the shell, a bottom hearth for the shell situated below the lowermost hearth of the series of hearths a distance in excess of the distance between said hearths to provide an enlarged combustion chamber, means for admitting combustible fuel and air for supporting combustion within the said chamber, a series of rabble arms carried by the rotatable column and movable over the bottom hearth of the calciner for advancing calcined mat. to a discharge outlet, and a plow-shaped rabble tooth covering for each of the rabble arms associated with the said bottom hearth.

Kilns, Furnaces, Fuels and Combustion

Surface combustion and its application. W. M. HEPBURN. *Assoc. of Iron and Steel Elec. Engrs.*, **5**, 497-512(1923).—H. discusses the principles of surface combustion and its application to specific furs. The practical utility of combustion involves 3 considerations: (1) the combustion, (2) the furnace, (3) the supply systems. Surface combustion is accomplished by firing an accurate and intimate mixt. of air and gas in a multiplicity of minute intensely hot combustion chambers (under-fired refrac. beds or refrac. diaphragm burners), causing rapid combustion. Such combustion causes large increase in ht. transmission. The desired characteristics of surface combustion equipment are discussed; these include: (1) correct and constant ratio of air and gas; (2) intimate mixing of air and gas; (3) a restricted and definite controlled zone of combustion. Automatic proportioning for maintaining control of the combustion zone is accomplished by the refrac.-bed type and the tunnel type of firing. The intense temp. is obtained in both by localizing the zone of combustion; in the refrac.-bed type the mixt. of gas and air is impinged upon a bed of refrac. granules, and in the tunnel type the zone is localized by sudden expansion in a molded tunnel. The hot surfaces of the granules or tunnels have an accelerating effect on the speed of combustion. In the refrac.-bed type, the burner projects the mixt. into a pocketed bed of refrac., which can be any sub-

stance capable of withstanding temps. over 3400°F, while in the tunnel type, an accurately molded minimum size combustion chamber lined with cement, also capable of withstanding over 3400°F, is used. By minimum size is meant the smallest possible space in which the mixt. capacity of the particular burner can be burned. Examples with figures are given showing the application of these two types to particular furs. The refrac.-bed type has been applied to steel heat-treating furs., and the tunnel-type to pot melting furs. Stacks are used with surface-combustion systems only as passages for flue gases; no draft is required. Pressures required are 1 lb. for producer gas, 8 lbs. for coke-oven gas, and 20 lbs. for natural gas, where compressed gas is used. Some htg. operations are best performed by surface combustion, while others are better carried out by regenerative and recuperative methods. R. J. A.

Oil firing of ceramic kilns. SYMPOSIUM. *Ceramist*, **3**, 77–114(1923).—F. W. WALKER. Average coal consumption for 73 16-ft. downdraft kilns burning wall tile to cone 10 was 12.8 tons of coal; gas consumption for these kilns 360,000 cu. ft. If the coal is considered as having 14,000 B. t. u. per lb. and gas 1000 B. t. u. per cu. ft. and assuming equally efficient combustion conditions, this shows a thermal variation of less than $^1/_2$ of 1%. A smaller updraft kiln 10 ft. 6 in. diameter showed a coal consumption of 8.85 T. as compared with 269,000 cu. ft. natural gas, the thermal consumption being 8.56% greater with gas than with coal. In comparing the consumption of gas with oil when burned in a Dressler tunnel kiln fired to cone 1 over a considerable period and considering the oil as having 142,000 B. t. u. per gallon 20% more oil fuel is used. This agrees closely with the experience of 2 other companies where direct comparisons have been possible. Improvements in designs and operation of furs. will probably reduce this apparent difference. *Comparison of costs:* Assuming the thermal efficiency of these fuels to be the same, a comparison of burning costs including labor, maintenance and sagger breakage charges is made. For this purpose 28,000,000 B. t. u. (the equivalent of one ton of coal of 14,000 B. t. u. per lb.) is taken as a basis of comparison which figure corresponds to 197 gallons of 28 Bé. Penn. oil (thermal value 142,000 B. t. u. per gallon) 28,000 cu. ft. natural gas (thermal value 1000 B. t. u. per cu. ft.). The total costs for one month are given below. Author states costs given for oil are based upon experience of others together with limited personal experience.

	Coal	Gas	Oil	Expressed in per cent:	Coal	Gas	Oil
Cost of fuel	$6.05	$12.60	$12.25	Fuel	46.2	83.5	78.2
Labor cost	2.72	1.04	1.04	Labor	20.4	6.9	6.6
Maintenance	1.42	.24	.87	Maintenance	10.8	1.6	5.5
Sagger breakage	2.95	1.22	1.53	Sagger breakage	22.6	8.0	9.7
Total	$13.14	$15.10	$15.69	Total	100.0	100.0	100.0

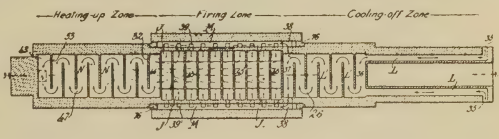
The av. compar. values of the 3 fuels for 25 months are as follows: Oil, $16.59, 129.2%; Gas, $15.25, 118.8%; Coal, $12.84, 100.0%. W. discusses fuel storage, labor and control devices and the effect of these fuels upon the quality of the finished ware. With respect to the latter he is of the opinion that with very few exceptions equal results may be had with each fuel. J. A. WILLIAMS discusses the use of oil fuel in a plant engaged in the manuf. of a white vitrified body burned to cone 12 in one fire. The costs of oil burning equipment are given. A 13-ft. kiln using 6 burners with average burn of about 44 hrs. used about 1760 gals. of oil for each burn. A 14-ft. kiln having a greater height than the kiln previously referred to and having 8 burners uses about 2300 to 2400 gal. of oil per kiln for a burn of about 42 or 44 hrs. duration. Best grade of fuel oil obtainable is used. It has specific

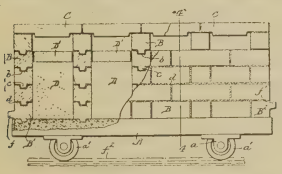
gravity of 36 to 49° Bé. DONALD HAGAR describes the equipment of a low pressure system in use on kilns burning wall and floor tile to cone 10. It has been found that the cost is slightly more to burn bisque kiln with oil than with coal. Also, the data obtained in another plant of the same company shows that oil fuel costs from $15 to $20 less per kiln than natural gas at 45c per 1000 cu. ft The oil used has a thin asphalt base with a specific gravity of 24° to 28° Bé. which is very satisfactory for use in cold weather. R. L. CLARE describes the use of fuel oil in burning terra cotta kilns. The equipment required is stated and theoretical advantages of oil are discussed. No factory data is included. F. N. TUCKER describes the use of fuel oil equipment in a terra cotta plant. No factory data is given. C. W. P.

Growing use of oil fuel in ceramic plants. ANON. *Ceramist*, **3**, 111(1923).—A short list of plants using oil fuel is given and the statement is made that the National Porcelain Works, at Sevres France, is using oil fuel. This has made possible a reduction of the period of burning from 25 hrs. required for wood fuel to 16 hrs. for oil. It is stated that the oil-fired ovens have given ware of a purer and more uniform color. C. W. P.

PATENTS

Tunnel kiln. LOUIS A. WITTE. U. S. 1,471,875, Oct. 23. A tunnel kiln comprising a continuous lining forming a tunnel chamber and an enclosing masonry structure forming an intervening space divided by transverse partitions, said structure having a central zone with combustion chambers, a heating-up zone with flues for the circulation of combustion gases through such space around the chamber, and a cooling zone with air flues for heating air for combustion purposes by means of the heat transmitted through the walls of the chamber.





Tunnel kiln car. HARRY D. LILLIBRIDGE. U. S. 1,473,152, Nov. 6. In a vehicle of the class described, a load-carrying structure embodying bricks or slabs provided on their meeting faces with mortices and tenons, said bricks or slabs being interlocked and bonded to preclude dislodgment of the bricks under the stresses ot the load and upon disintegration, more or less, of the bonding medium.

Geology

Silica in Canada; Its Occurrence, Exploitation and Uses. L. HEBER COLE. Pt. I. Eastern Canada. Canada Dept. of Mines. Ottawa: Government Printing Bureau. 126 pp. (*C. A.*)

Prepared non-metallics (Consumption and possibilities of development). S. J. COOK. *Can. Chem. & Met.*, **7**, 226(1923).—This review gives a summary of an investigation conducted by the Dominion Bur. of Statistics with a view to determining the consumption in Canada of prepared non-metallics. The list of minerals covered was as follows: Actinolite, arsenic, asbestos, barytes, calcite, whiting, chromite, corundum, magnesite, magnesium sulphate, manganese, mica, nitro-alunite, iron oxides, phosphate, pyrites, silica or quartz, sodium sulphate, talc and tripolite. The fields of use covered are as follows: fertilizers, medicinal and pharmaceutical prepns.; explosives, fireworks and matches; paint and soap industries; inks, dyes and colors; polish and dressings, pottery, stoneware, porcelain and enamelware, tanneries, artificial abrasives,

asbestos products, rubber industry, oilcloth and linoleum, roofing and wallpaper. All have detailed tables of statistics and form a very fine report. O. P. R. O.

Physics and Chemistry

Mechanical testing of finished ceramic products. M. Gary. *Sprech.*, **56**, 429–33 (1923).—Methods for testing true sp. gr. and apparent sp. gr. are described. The absorption is detd. by saturating the test pieces under press. with H_2O. Methods for detg. the apparent porosity and true porosity are also described. Laminations are detected by means of a magnifying glass. The degree of vitrification of elec. porcelains are detd. by subjecting test pieces in a soln. of fuchsin in methyl alcohol to a pressure of 15 atms. When subjected to this test the dye should not color the specimen. A water soln. of brilliant green may be used in the place of the extremely poisonous methyl alcohol soln. Special briquettes are described for measuring the tensile strength. Cross-breaking tests are made on 16 mm. by 120 mm. test pieces and the modulus of elasticity is detd. while making this test. For testing the resist. of porcelains to impact the pendulum methods are employed. The compression strength is detd. by means of a hydraulic press. The hardness of ceramic bodies is determined by means of a sand blast. This is allowed to act upon the body 2 mins. and the loss in wt. is used as a means for comparing different wares. H. G. S.

Effect of alkalies on clays and clay products. Anon. *Ceramist*, **3**, 48–55(1923).—A brief résumé of our knowledge regarding the influence of sol. salts upon the amt. of water of plasticity, the working properties of clay, its drying shrinkage, drying behavior, and faults attributable to the presence of sol. sulfates in pottery bodies as well as brick. A gravimetric method for the detn. of sol. salts is given in detail with reference made to the use of an elec. method. C. W. P.

Notes on the crystalline structure of some china clays examined by the X-ray powder method. William Bragg, G. Shearer and J. W. Mellor. *Trans. Ceram. Soc.* (Eng.), **22** [1], 105(1922).—In practice, it is convenient to use a fine slit $^1/_2$ mm. wide and 1 cm. long to define the X-ray pencil. The photographic plate will then show, if it is limited to a strip a little wider than the length of the slit, a series of fine lines, like an optical spectrum, and each such set of lines is unique and belongs to one crystal only, or to an agglomerate of crystals. H. F. S.

Forces of adhesion in solution. II. Coagulation of coarse suspensions. Sergius Wosnessensky. *Kolloid-Z.*, **33**, 32–4(1923); cf. *C. A.*, **17**, 1572.—The coagulation by common electrolytes of coarse suspensions of kaolin, $Al(OH)_3$, and Sb_2O_3 was studied. No single electrolytes, with the exceptions of $Ca(OH)_2$ and $Ba(OH)_2$, had any coagulating effect. Marked coagulation occurs with the simultaneous action of bivalent or tervalent metal salts and caustic alkalies, *e. g.*, $BaCl_2$ and NaOH, or $AlCl_2$ and NaOH. These materials form difficultly sol. hydroxides, which are adsorbed on the surface of the particles of the suspension and cause coagulation by changing the forces of adhesion and cohesion. Materials such as NH_4Cl and tartaric acid which hinder the formation of hydroxides disturb the coagulation. The thickness of the absorbed hydroxide is estd. to be of mol. dimensions. C. B. E. (*C. A.*)

Experimental studies of the coagulating powers of electrolyte series. Agnes Ivanitzka and L. Orlova. *Kolloidchem. Beihefte*, **18**, 1–38(1923).—The coagulating powers of several series of electrolytes were studied with the following hydrosols: negative—mastic, sulfosols of As_2S_3 and Sb_2S_3, S, Au, Pt, Berlin blue, MnO_2 and $Fe(OH)_3$ positive—Fe_2O_3, Al_2O_3, Cr_2O_3 and AgBr. In general, the anion series with a const. cation is antivalent for negative sols and convalent for positive sols, whereas the cation series with a constant anion is convalent for negative sols and antivalent for positive sols. Comparative studies of electronegative suspensions of coal in alkaline media

and electropositive suspensions of Fe_2O_3 in acid media were made with true sols and on marked differences were observed in their ability to coagulate by electrolytes. The following substances were added to the dispersion medium of the suspensions to determine their effect on their coagulation by electrolytes: MeOH, AcH, glycerol, Na protalbinate, dextrin and gelatin. Nonelectrolytes affect the stability of the suspensions as well as the rearrangement of the electrolyte series in their coagulating powers. Coagulation is considered to be not simply the result of physical factors, *i. e.*, surface tension, dielec. const., etc., but of relations among all components of the coagulating system, *i. e.*, disperse phase, dispersion medium and electrolytes. I. N. K. (*C. A.*)

The transition in case of mechanical subdivision of crystalline hydrates of the water of hydration into adsorbed water. T. HAGIWARA. *Kolloid Z.*, **32**, 154–6(1923).—$Al_2O_3.3H_2O$ and quartz dried to const. weight were ground in a *colloid mill* and then kept at higher temps. in the desiccator. Weighing showed that at a sufficiently fine state of subdivision of $Al_2O_3.3H_2O$ its water of hydration loosens its firm bond and assumes the properties of adsorbed water. (*C. A.*)

Physical chemistry of the crystalline state. F. KÖRBER. *Z. Elektrochem.*, **29**, 295–301(1923).—An address on X-ray analysis and the study of solids. H. J. C. (*C. A.*)

Fusion, solution and ionization. W. F. SHORT. *N. Zealand J. Sci. Tech.*, **5**, 43–5(1922).—A short discussion in which these phenomena are considered as essentially the same and explained on the basis of radiation hypothesis. A. E. S. (*C. A.*)

Acid borates of sodium. I. F. PONOMAREV. *J. Russ. Phys. Chem. Soc.*, **49** [1], 229–40(1917).—By employing the principle established by Tammann (*C. A.*, **8**, 2971) P. succeeded in prepg. cryst. borates contg. a greater proportion of B_2O_3 than that in borax ($Na_2O.2B_2O_3$). This was accomplished by htg. fused mixts. of borax and anhyd. B_2O_3 in a Pt boat placed horizontally inside of a hard-glass test-tube. The heating being restricted to one end of the boat, a slowly falling temp. gradient was obtained along the fused mass, and the crystn. of the desired borates started at the point possessing the optimum temp., which lay in the middle region between the molten fluid at the heated end and the solid vitreous portion at the cold end. Since at the temp. of formation of the cryst. nuclei the mixt. is extremely viscous and the motion of the crystals very slow, it was possible to measure, with a thermocouple, the limiting temps. of the cryst. formations. Chem. and crystallographic studies were made of mixts. of the oxyborates $Na_2O.3B_2O_3$ and $Na_2O.4B_2O_3$ so obtained. W. A. P. (*C. A.*)

The third principle of thermodynamics and some of its consequences. A quantitative application of Berthelot's principle. VL. A. KISTYAKOVSKII. *J. Russ. Phys. Chem. Soc.*, **53**, I, 247–55(1921).—A quant. formulation of Berthelot's principle of *maximum work* was made which permits of broad applications to the detn. of such quantities as the heat of transformation, the free energy of compds., etc. A restatement of Berthelot's principle is briefly given as: "For every transformation of substances, chem. or phys., a characteristic point may be found by varying the temp. and pressure at which point $A_1 = Q_1$, *i. e.*, the free energy = the heat of transformation, and at the same time $dA/dT = 0$, or, when the 1st deriv. of the free energy to the temp. (the temp. coeff. for the given point) is also = 0." Nernst's theorem presents a special case of the above postulate, namely where $T = 0$. The application of the above principle also leads to the equation $q = T(dA/dT)$, where q is the heat of the side process accompanying the chem. reaction. This leads to the condition in which with small increase in temp. Q becomes either greater or less than A. By using the last equation the temp. coeff. of galvanic elements can be calcd. from the heats of fusion of ice and Hg. It also gives a simple formula for the latent heat of vaporization of poorly associated liquids (cf. following abstr.). The general problem of the max. work which can be obtained from any given reaction is discussed. W. A. P. (*C. A.*)

Latent heat of vaporization. VL. A. KISTYAKOVSKII. *J. Russ. Phys. Chem. Soc.*, **53**, I, 256–64(1921).—A new formula for the calcn. of the heat of vapn. of unassociated liquids was worked out by applying the 3rd principle of thermodynamics (cf. preceding abstr.). The formula is $JQ = RT \ln RT$, which states that for unassociated (or poorly associated) liquids, whose vapors at the b. p. have the normal mol. wt., the heat of vapn. = the vol. of the vapor multiplied by the natural log of the same vol. J is the mech. heat equiv. in joules, Q is in large cals., the gas pressure is in atm. and the vol. in cc. Satisfactorily agreeing values for Q were calcd. by the use of this formula for 74 poorly associated liquids which includes all of those given in Landoldt-Börnstein, *Phys. Chem. Tabellen*, **1912**, 834–42, in addn. to some others of previous Russian data. The new formula does not contain any empirical factors and it is offered by K. as the law of the latent heat of vapn. for unassociated liquids at their b. ps. and at 1 atm. pressure. W. A. P. (*C. A.*)

The behavior of pumice stone during the dehydration of organic liquids. ARMIN SEIDLENBERG. *J. Assoc. Official Agr. Chem.*, **7**, 98–106(1923).—Pumice stone, or any substance consisting of small particles or having numerous fine capillary openings, has a greatly increased tendency to adsorb liquids and gases, particularly after being heated. The wt. of material in this condition is affected to a marked degree by changes in temp. and pressure. It gains wt. after being heated while in a desiccator, and also during the process of weighing. For this reason also it readily adsorbs moisture from the atm. or from liquids spread over it. This adsorbed moisture is held very tenaciously and can only be removed by heating the pumice to redness. It appears that the presence of this adsorbed moisture has a decisive effect in accelerating the decompn. of org. residues distributed over the pumice. When the pumice is heated to redness before being used and all the moisture thus expelled, an approx. const. wt. may at times be obtained due to the balancing effect of 2 opposing errors. This const. wt. may or may not be correct and checks can usually be secured only by prepg. all the pumice used under identical conditions. Where the pumice is dehydrated at the comparatively low temps. used for the evapn. of the liquid it is not possible to secure significant results that will indicate the true amt. of solid matter present. If too low a temp. is used not all the H_2O is expelled, particularly in the presence of viscous material. With higher temps. it is not possible to secure a distinct end-point that will clearly distinguish between the loss due to the decompn. of the solid and that due to the evapn. of the liquid portion, and it is not possible to attain a significant "const. wt." that indicates the correct result. J. A. K. (*C. A.*)

PATENTS

Mica, asbestos, and like compositions. PLAUSON'S (Patent Co.), LTD. Brit. 193,520, Nov. 29, 1921. Residues of mica, asbestos, talc, and similar silicates are partly or wholly converted into the colloidal state by high-speed mech. disintegration, preferably in a colloid mill as described in 155,836 (*C. A.*, **15**, 1788); the colloidal soln. is subjected to ultrafiltration, dried *in vacuo*, and molded under pressure. Dispersion-accelerators such as colloidal silicic acid, alkali silicates, colloidal ZnO, aluminates, sulfite-cellulose liquor, gum arabic, and tannin may be employed. Fillers or binding agents such as rubber, natural or artificial resins, drying oils, olein, and finely divided clay may be added to the silicate either before or after disintegration. (*C. A.*)

General

Burning wood for heating steam boilers. PIERRE PRÉVOST. *Rev. Mat. Constr. Trav. Pub.*, **168**, 204–5(1923). L. N.

Asbestos industry, S. Africa. ANON. *Mining & Eng. Jour.*, **34**, 465(1923).—

S. Rhodesia has recently become an impt. producer of asbestos, averaging some 12,000 T. annually; further important deposits are being developed in the Transvaal and Natal; also Mozambique. Only 2 or 3 plants in S. Africa make finished products, The raw mat. is first crushed and fiberized, and all foreign elements eliminated without destroying its fibrous qualities. It is then beaten to a pulp and mixed for about 15 min. with Port. cement. If red tiles are to be made, a small quantity of powdered red iron oxide is added. The mixt. is carried by flumes to a mach. which turns out the pulp in large slabs. These are placed in an edge trimming mach. for squaring or cutting into tiles, and thence to an hydraulic press, where the slabs are pressed between steel plates. The finished slabs or tiles are then "cured" by being kept in a drying shed for about 2 months, after which they are ready for a variety of industrial uses. The mach. which converts the pulp into slabs is most interesting in its opern.; one of the rollers picks up the absestos-cement pulp and spreads it layer upon layer on an endless traveling belt. From this it passes to a steel collecting drum; when the pulp is of sufficient thickness a bell rings and the operatives strip it off in the large slabs. Sheets may thus be turned out in varying thicknesses—say from one-eighth to one inch—by increasing or reducing the number of layers of pulp. Millboards made entirely of asbestos fibre are also made, and for this and the asbestos-cement products there is a great variety of uses, apart from bldg. purposes, such as door panels, chair seats, cattle and poultry troughs, road signs, filing cabinets, table-tops, basin and dishes, school blackboards. O. P. R. O.

A visit to the potteries of Norway, Sweden and Denmark. DOGAR SINGH. *Trans. Ceram Soc.* (Eng.), **22** [1], 29(1922–23).—"The Porsgrund Pottery Factory" was established in 1885, by the Norwegian Govt. The body mixt. consists mainly of feldspar, quartz, and china clay. The machinery which is used for pugging the body mats. for mfg. hollow ware and flat ware is very economical and scientific. One man and one boy can make 1500 plates in a day. The stove room is also of quite a new type. Each room has 20 compartments and each compartment is divided into 10 shelves, erected on a 4-wheel wagon. When the goods are dried the whole compartment is pulled out and brought to the lift by which it is carried down to the first floor, whence it is taken to the bisque oven. All stoves for drying purposes are on the top floors and utilize the surplus heat given out by the kilns while cooling. Another process, a German patent, is for engraving steel instead of copper plates, for printing purposes. The Rorstrand factory at Stockholm specializes in mfg. porcelain for elec. purposes. These insulating fixtures are made of a mixt. of white-burning clays, feldspars and flint. Articles like wiring fixtures, knobs, cleats, receptacles, attaching plugs, and switchboards are made by the "dust press" method. The presses are very simple, each making from 1500 to 3000 pieces in a day, according to the size of the piece. All these pieces are finished by one firing. Each piece is sent to the testing shop where it is elec. tested. Most of them are tested by a very high tension current of from 2000 to 4000 kw. In Höganas, there is one of the largest concerns for refractory goods in Sweden. This factory also manufactures all sorts of acid jars and sanitary ware. The mats. from which the silica bricks and slabs are made are quartz, sand, fireclay and quartzite. The Bing and Grondahl Porcelain Works are located in Copenhagen. They have charming pieces of statues and cryst. glazes; almost all the figure work has been copied from the Royal Museum from the models of Thorwaldsen's works, the famous Danish sculptor. Here they are making expts. for firing their goods with liquid fuel. They make hotel and ship ware, which are generally sold to Spain, France, England, and South America. The Royal Copenhagen Factory has a special reputation in the pottery world for its under-glaze colors. A few years ago, the factory purchased a new plant for crushing and grinding the raw mats.; this is worked by only two men. This factory has its own special color-mfg. branch, which is run by a skilled and trained man. By the use of pure Norwegian

and Swedish feldspar and quartz, and the finest English china clay, the most charming and attractive goods are manufd., and on them life-like paintings of birds, fishes, animals and water or landscapes, or figure subjects are painted in elegant and admirable underglaze or enamel colors, such as cobalt blue, peacock blue, pink, crimson, greys and greens. Special attention has been given by the Danish factories to the manuf. of saggers. Two pug mills are erected for thoroughly pulverizing and mixing the clay and the grog together. One pug mill is vertical and one is horizontal. H. F. S.

The Danish ceramic industry. CARL JACOBSEN. *Trans. Ceram. Soc.* (Eng.), **22** [1], 20(1922–23).—Boring operations, carried even to the greatest depths at various places all over the country, have yielded evidence of comparatively recent sedimentations only. China clay, high-grade refrac., white burning plastic clay and coal are nowhere to be found in Denmark. Clay suitable for bricks not of very good quality is found in large quantities all over the country. The 200 brick plants of the country produce, in normal times, from 400 to 500 millions annually. In addition to bricks, the brick plants also produce roofing tiles and drain pipes. Bornholm possesses a fairly large deposit of pure china clay. It was formerly used for making china. It is too ferruginous to produce an absolutely white porcelain. Nowadays, it is used for earthenware, in the manuf. of paper, and finally for mixing with fireclay to make refrac., clinkers and saggers. Fireclay of a good, though not of the very best, quality is found in many localities in Bornholm. The Danish common pottery indus. is represented by about forty small works, which turn out both glazed and unglazed ware. Of far greater interest is the artistic ware, with a porous body, which by close coöperation with native artists of distinction, has now attained a high standard. Modern Danish earthenware is produced at the "Alumina" Works, which are associated closely with the Royal Porcelain Works. The concern is now known as the "Copenhagen Fayence Factory." The biscuit ware is fired in a newly erected, continuous, gas-fired Mendheim kiln. A highly important indus. development was initiated by Bing and Grøndahl in the manuf. of tech. porcelain, particularly for elec. purposes. Another concern, the Dansk Porcellanisfabrik, of Kastrup, in Amager, also manuf. electro-technical porcelain. H. F. S.

Kaolin. ANON. *Mining Operations*, 81–2(1922).—Considerable development work was effected, 1922, of the kaolin deposits of Amherst township, P Q.; length of prospecting drifts and cross-cuts totaling 1250 ft.; a large quantity of kaolin, contg. an average of about 50% of white quartz sand has been blocked out. The very ingenious method of mining adopted to bring the crude clay into soln. underground, and to pump this thin pulp from a pump situated in the main drift, to the surface, is really underground hydraulics. The pump installed is a 3-in. two-stage Morris centrifugal sand pump, directly connected to a 60 h. p. elec. motor; the capacity of the pump, at 1200 r. p. m. would be 300 gal. a minute, containing 10% of solid matter. The thin pulp from the pump goes into a settling cone, 8 ft. in diam. in which the coarse sand drops to the bottom and the clay and fine sand in suspension overflows with the water into two sets of troughs each 1000 ft. long, along which the fine sand falls and settles on the bottom, and the jet of water holding the clay goes to eight large settling tanks, the largest of which measures 75 x 72 x 7 ft. After drawing off the top liquid, the settled pulp which now holds 30% china clay, is pumped to the filter-presses under a pressure of 100 lbs. per sq. in. The filter-cakes, which contain about 25% moisture, are placed on racks, and wheeled on cars, into a drying chamber through which circulates a current of hot air. When completely dry, the cakes are broken up and put in the bin, ready for the market. O. P. R. O.

In burning carbon which is formed first, carbon monoxide or carbon dioxide? CARL KULLBERG. *Teknisk Tids.*, **53** (Kemi), 41–6(1923).—Coke was heated in a current of air under proper exptl. control and the CO and CO_2 were detd. Both CO and CO_2

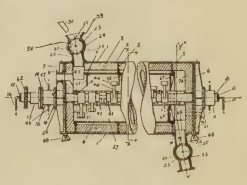
were formed directly from the C and neither one can be considered as primary with respect to the other. The relative amts. depend upon the temp. With an increase in the temp. there was a relative increase in the CO_2. For 360° the figures reported indicate that there was 1 part CO to 4 parts CO_2. The burning of the CO to CO_2 is a relatively slow reaction and in the course of the expt. (360° series) only about 10% of the CO formed was oxidized. This work is in reply to the theories of Aufhäuser at present debated in the German journals. (Cf. book reference under A. in *C. A.*, **16**, 1311.)

A. R. R. (*C. A.*)

Research, an industrial investment. H. E. Howe. *J. Am. Leather Chem. Assoc.*, **18**, 465–75(1923).—A plea for research in fundamentals. Instances are cited of the great rewards attending persistent research. J. A. W. (*C. A.*)

PATENTS

Retort for the distillation of shale, bituminous coal, and other materials. Claude M. Garland. U. S. 1,473,616, Nov. 13. In a device of the character described, a substantially horizontally arranged cylindrical retort, a charging device located near one end of the said retort, a discharging device located near the opposite end of the said retort, a false head near the discharge end of the said retort, an aperture for the discharge of material located in the said false head and a gate for varying the opening of the said aperture.



Pottery, bricks, etc. M. Bacchiolelli and A. Meifree-Devals. Brit. 196,342, Jan. 14, 1922. Igneous rocks such as lava, basalt, dolerite, greenstone, etc., for use in pottery and making brick and tile, are crushed to powder and agglomerated under the influence of heat (with or without the addn. of impoverishing substances such as chamotte, quartzite, sand, etc., or fluxes) at a temp. lower than their own m. ps. The rock may be crushed to powder and porphyrized and if desired mixed with impoverishing materials and H_2O added to form a paste. It is then shaped by any known process either in the mold with or without pressure or in the lathe or by pouring in the state of slip in an absorbing mold. After being finally fashioned, it is dried and fired at the required temp. Other processes are stated. (*C. A.*)

CERAMIC ABSTRACTS

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Ross C. Purdy, Editor
Emily C. Van Schoick, Asst. Editor

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Art

Ceramic mosaic: standardized sheets and patterns. Associated Tile Mfgrs. (Beaver Falls, Pa.) *Arch. Forum*, **29** [5], 248–9(1923).—This mfg. catalog includes borders, all-over patterns, and diapers of various sorts, illusd. in color with sizes of the sheet units which are to be had. It represents the first fruits of standardization work carried out among ceram. mosaic mfgrs. through the assoc. F. T. H.

Cement, Lime and Plaster

The actual uses of alumina cements. Edwin C. Eckel. *Concrete*, **23**, 175–6 (1923).—Alumina cement of Amer. mfg. will be on the market in important tonnages from next spring onward. It has been manufd. and used in Europe in commercial quantity for several yrs. The alumina cements have been used in 2 different fields, each employing primarily one of its 2 exceptional qualities: (1) its resist. to chem. attack; (2) the great rapidity with which it attains max. strength. This article deals with resist. to chem. attack only, a later one to treat on quick-setting properties. A French railroad found difficulty with Port. cement in masonry work in tunnel construction in regions of alkali-water. Bied worked out these low-index alumina cements to fit this particular trouble some 15 years ago, and solved the problem. (See following abstract. Also *Ceram. Abs.*, **2** [5], 91(1923).) Three cases are cited where concrete of alumina cement resists the action of sea water better than that from Port. cement. A number of plants engaged in various branches of the chem. indus. have tried and are still trying alumina cement for tank linings, drip boards, etc. In some of these uses it has succeeded and will have a utility, in others it has failed just as badly as all of its predecessors, Port. cement included. F. T. H.

New cements and old, and what we may do with them. Editor. *Concrete*, **23**, 173–4(1923).—An article on quick-hardening cement (alumina cement) is quoted from *Concrete and Constructional Engr.* (London) in which it is concluded that it is "not without value to the user of Port. cement that the appearance of a rival cement in the market may stimulate research and possibly lead to the production of Port. cement with quick-hardening qualities." F. T. H.

High-alumina cement. J. Bied. *Revue Universelle des Mines*, July 15, 115 (1922).—Aluminous cement is essentially a cement in which the alumina content is greater or at least equal to the silica content. Ordinary Port. cement has been found to be attacked and decomposed by sea water and in tunnels and other masonry exposed to ground waters contg. calcium sulphate or magnesium sulphate, it has been found to de-

teriorate and decompose. This deterioration has been explained by the formation of the sulpho-aluminate of lime which crystallizes with 32 moles of water and the enormous increase in volume breaks down the structure. Pozzolini cement cannot be successfully used where it is warm or damp. In his researches, Vicat discovered that any cement with an index or ratio $\frac{\text{silica} + \text{alumina}}{\text{lime} + \text{magnesia}}$ greater than 1 would not be decomposed by sea water. The aluminous cements have an index exceeding 1. Tests of CaO, Al_2O_3 and 3CaO, $5Al_2O_3$, the principal aluminates present in this cement, made by P. A. BATES (Bur. Stand., Washington) show that the addn. of gypsum reduces the strength. The time of setting varied, the initial set being from 25 min. to 5 hr. and the final set from 50 min. to 7 hr. A test piece made of neat cement attained a strength of 25 kg. in 24 hr. and 56 kg. in 28 days. The mortar attained an equal strength of 24 kg. in 24 hr. but only 50 kg. in 28 days. In compression the mortar reached a strength of 250 kg. in 25 hr. and 400 kg. in 7 days, and 500 kg. in 28 days. These mono- and semi-calcium aluminates give an almost instantaneous set if mixed with as little as 1% of lime or 3% Port. cement. Bates confirmed the general fact that this cement is stronger in a mortar than pure, and stronger in a concrete than in a mortar. The set of aluminous cement commences in about 4 hr. and is complete in about 7 to 8 hr. The hardening is very rapid and in 72 hr. one can guarantee a concrete as strong as can be made using Port. cement in 90 days. Added to this is a resist. to decompn. Contrary to other cements, aluminous cement starts hardening on the interior and progresses to the outside. It has a coeff. of elasticity, almost twice that of ordinary cement. A typical analysis is as follows: Silica, 10 to 12%; Alumina, 40 to 45%; Lime, 35 to 40%; Iron oxide, 15 to 20%. The index of this is better than 1.25. Ordinary Port. cement has a silica content of 20 to 22%, alumina, 6 to 8%, and lime, 64 to 65%. Aluminous cement is produced by fusion either in an elec. or water-jacketed blast fur., or by clinkering in a rotary fur. A mixture of bauxite and limestone is used. In the blast fur., the iron oxide of the bauxite is completely reduced to steel which has a m. p. above that of the cement, and in order to tap it from the fur. a large excess of coke and a hot blast is necessary. This has lead to the introduction of heat interchangers. In the manuf. with the elec. fur. the chief difficulty is the low condy. of the alumina and limestone requiring the use of the arc fur. resulting in excessive current and electrode consumption. The rotary kiln is not so readily adaptable to the manuf. of this cement because the aluminates desired do not form readily below the fusion temp. which is much higher than that required for clinkering Port. cement. The rotary kiln would be best if refractories could be found to withstand the molten cement. There is a possibility of burning the cement mixt. in kilns such as are used for refrac. bricks. The mixt. would be made into bricks and held at a temp. just below the fusing point until vitrification took place. See preceding abstract. F. T. H.

Good mortar, mortar joints and mortar colors. ANON. *Concrete*, **23**, 97(1923).—The essentials of good mortar are: (1) It should be dense and non-absorbent. (2) It must have a sufficient compressive strength to withstand pressure in the wall without crushing. (3) It must attain strength rapidly. (4) It must be reasonable in cost and easily obtainable. (5) It must possess good working qualities. (6) It should look well. (7) It should endure permanently. Mixts. and methods for attaining these results are briefly described. F. T. H.

The Spanish cement tile industry. FRANK ANDERSON HENRY. *Concrete*, **23**, 98(1923).—Annual production of factories in Spain exceeds 300,000 sq. m. of concrete tile. Cement tiles are used for floors in place of wood. Ordinary natural colored tile are used for warehouse and factory floors and colored mosaic tiles for residence floors. The process of mfg. is described. F. T. H.

Material dealer furnishes concrete ready mixed. ANON. *Concrete*, **23**, 99(1923).—A brief description of a central mixing plant. Concrete must be used within 45 min. from time it is mixed. F. T. H.

How to make concrete roof tile. CRAWFORDSVILLE FOUNDRY CO. *Concrete*, **23**, 120–1(1923).—Specifications for mats., proportioning, machine operations and curing are described and details of equipment illusd. F. T. H.

Pittsburg, Calif. road tests. ANON. *Concrete*, **23**, 126–7(1923).—Tabulated results of tests of 13 diff. sections of concrete road giving a total computed cost including maintenance plus original cost. F. T. H.

Cost of reinforced concrete for lighter use in buildings. ANON. *Concrete*, **23**, 133–5 (1923).—A discussion of the economies of reinforced concrete skeleton construction as compared with masonry bearing wall construction. F. T. H.

Regulating setting time of Portland cement. ANON. *Can. Eng.*, **45** [20], 485–7 (1923); also **45** [21], 509–11(1923).—These articles form an abstract of Pamphlet No. 5, Brit. Port. Cement Research Assn. Experiments showed that higher temps. in the mass cause quicker setting. The setting process is more or less suspended around the f. p. of water. Increased propns. of gaging water in the mix cause somewhat slower setting. Pure, dry air has no effect upon cement samples but after about 20 weeks of exposure to the moist air of England, cement becomes practically inert, giving a loss on ignition about the same (14–15%) as set cement. Higher alumina contents and finer grinding both speed up the time of set. Various sol. salts have different effects; sea water for gaging slows up the setting somewhat. Exposure to moist CO_2 causes remarkable increases in setting speed, and also changes the character of the hardened mass. Water of crystn. is absorbed from salts by dry cement in contact with them, causing a retardation of set. Of many salts added, alkali carbonates had a marked accelerating effect on setting. Gypsum is uncertain and irregular in its effects as a retarder of setting. B. M. L.

Tests of caustic magnesia made from magnesite from several sources. P. H. BATES, ROY N. YOUNG AND PAUL RAPP. Bur. Stand., *Tech. Paper* **239** (Abstract).—The properties of oxychloride cement have been studied, particularly in reln. to the source (or properties) of the magnesite ores, conditions during the calcining process, and various oxychloride cement mixts. Ore from Greece, from 2 diff. sources in Calif., and from the State of Wash. were used, as these were representative of the chief sources of supply for this country. They include 2 diff. types of ore, the first 3 being amorphous, and the last cryst. Each ore was crushed and sepd. into 3 lots, differing only in size of particles. Size 1 contd. the particles which passed a 1-in. screen, but was retained on a $^1/_2$-in. screen; size 2 passed a $^1/_2$-in. but was retained on a No. 4 sieve; and size 3 passed a No. 4, but was retained on a No. 8 sieve. Each lot was then calcined in a 3 by 30 ft. rotary kiln under fixed conditions throughout the opern. The temp. range, including all burns, was from 700 to 1100°C. After grinding the caustic magnesia (the product from the kiln), the fineness, sp. gr., wt. per cu. ft. (loose and packed), loss on ignition, carbon dioxide content, and index of refraction were detd. There was difficulty in detg. the fineness, particularly in the use of the No. 200-sieve, on account of the finest particles of the very active magnesias adhering to the screen or agglomerating into larger particles during the opern. There were wide differences between loose and packed weights per cu. ft., which brings out the importance of weighing caustic magnesia, when making up mixts., rather than measg. by vol. as some do. Although a min. and max. carbon dioxide content has often been used in specifs. for caustic magnesia, no reln. was found between this constituent and the behavior of the oxychloride product. The index of refraction gives promise of being valuable in detg. degree and uniformity of burning, but will not indicate changes in the mat., occurring during storage, that have a marked

effect on the properties of the cement. It was necessary to "age" some of the very active magnesias to make them usable. Caustic magnesia from each lot was used in mixes prepd. according to 3 flooring, 2 stucco, and one lab. test formula. Only one concn. (22 Bé.) magnesium chloride soln. was used for mixing with the dry mat., as this concn. is conceded to be the best for general use. Service tests were made in conjunction with the lab. tests. The consistency of the wet mixt. (excepting the lab. test mix) was such as is generally used in practice, and was kept the same in all cases, as nearly as possible. The service tests consisted of the laying of flooring panels; erection of stucco panels, all exposed to actual service conditions; and subsequent observations, including meas. of linear changes. Three types of specimens were used in making strength tests. The briquette (of the shape used in the standard strength test for Port. cement mortar), for tensile strength; a $^1/_2$ by 2 by 13-in. bar for transverse strength; and a 2 by 4-in. cylinder, for compressive strength. In order to get an indication of the effect of intermittent wetting and drying of the set stucco during its early life, such as the material generally receives from exposure to the weather, specimens were tested in the following manner. After storing 21 days in the laboratory air, they were placed in water for one day, followed by one day in air under certain temp. and humidity conditions. This cycle of water and air storage was repeated twice, and after an additional day in air (making 28 days in all), the strength tests were made. Also, linear changes, resulting from this treatment, were detd. The lab. specimens for expansion tests were $^1/_2$ by 2 by 13-in. bars. The meas. were made by means of a 10-in. Berry gage. The results show that the various ores used require different conditions of calcination in order to produce caustic magnesias of approx. the same quality. Very light burning produces a magnesia which is too active for use in the customary oxychloride cement mixts. without "aging" or the use of a retarder. An increase in the degree of calcination increases the time of set of the magnesia. Also, the deg. of calcination affects, to a great extent, the strength, water resistance, and vol. change of the set cement mixt. However, there are other factors which influence these properties nearly as much if not more (within reasonable limits) than the burning. By the use of different types of aggregates with a magnesia, products very different in behavior under test, may be obtained. Also, by changing the proportion of given aggregates, the products may be made to differ widely. Therefore, a magnesia considered good in quality may be made to give very unsatisfactory results, and one considered very poor often may be made to give excellent results. (The complete paper may be purchased from the Supt. of Documents, Government Printing Office, Washington, D. C., price 10c.) H. F. S.

Proper handling of lump lime. Anon. *Contract Rec. and Eng. Rev.*, **37**, 1071, (1923).—When using a quick-slaking lime, if insufficient water is added, the paste is not as plastic and works short. It feels slightly gritty, and has a yellowish tinge. The temp. of the mass is raised considerably above boiling point, and a new chem. reaction takes place. This results in a formation of a subs. which absorbs carbon dioxide at a rapid rate, and thus hardens before it may be used. Exactly what this new compound is, has not been definitely detd., but the result is well known by those who use lime. In the case of "drowned" lime, the excess of water has absorbed too rapidly the ht. for slaking, and the change from quicklime to paste is retarded. When the paste is formed it is thin and watery and unsatisfactory. A good lime putty, properly prepd. and allowed to age or soak for some time previous to its use, makes a mortar or plaster that is easily applied; aging the paste imparts to it a degree of smoothness not otherwise obtained. O. P. R. O.

Effect of organic decomposition products from high vegetable content soils upon concrete drain tile. G. R. B. Elliott. *J. Agr. Research*, **24**, 471–500(1923).—Concrete

tile as at present made breaks down in all peat soils or when exposed to the action of peat waters. The more porous the tile the more rapidly it disintegrates, and an acid soil aids in the disintegration. A high percentage of lime in the soil delays but does not stop the decompn. of the tile. Methods are described for increasing the permanency of concrete tile in peat soils. W. H. R. (*C. A.*)

BOOK

Nineteen Stories of Lime. TRADE PUBLICATIONS. The title of a new book issued by the Central Division of the National Lime Association illustrating the various uses of hydrated lime in concrete construction. The various advantages which are attributed to the use of hydrated lime in concrete are: watertightness, workability and resilience. F. T. H.

Enamels

PATENT

Method of marking enameled ware. EMIL S. DENK. U. S. 1,473,903, Nov. 13. The method of marking enamel ware, comprising coating the enameled surface over the area to receive the mark with tacky material, applying to the coating an enamel, again coating the coated surface partially or wholly with a tacky material, applying to the part so recoated an enamel, and treating the ware to render the composite mark permanent.

Glass

On the refractive index changes in optical glass occasioned by chilling and tempering. F. TWYMAN AND F. SIMEON. *Jour. Soc. Glass Tech.*, **7** [27], 199(1923).—The changes in refractive index due to the tempering and chilling of a dense barium crown glass and a borosilicate crown were detd. The data is given and the results are plotted. *Conclusions:* (1) It has been established that the effect of chilling the dense barium crown glass and borosilicate crown samples referred to may be the lowering of the refractive index by as much as 0.004 in the case of the former, and 0.0013 in the case of the latter. (2) This lowering of refractive index is removable by htg. to a temp. for a length of time which have been ascertained for certain cases; (3) If the dense barium crown glass be cooled from the annealing temp. slowly under pressure, and measured not under pressure, the resulting refractive index is higher than when it is similarly cooled free from pressure, by amts. of the order of 0.00035; (4) The effect under (3) above seems to us to require further investigation for its complete elucidation, but for practical purposes the main effect of the chilling alone appears of importance; (5) It is clear that a want of homogeneity could be produced by molding, owing to surface chilling, which requires for its removal a longer maintenance at the high temp. than will suffice to remove elastic stress from the homogeneous sample. J. G. P.

A note on the suitability of quartzose residues for glass manufacture. D. J. REES. *Jour. Soc. Glass Tech.*, **7** [26], 130(1923).—The residues from the crushing plants in the Kolar Goldfield, Mysore, India, were examd. for the purpose of detg. their suitability for making glassware. This investigation indicated that residues such as those from the Kolar Goldfield would be a satisfactory raw mat. for use in the manuf. of common glassware when freedom from color is unessential. J. G. P.

The year in review in the world of glass technology. W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **7** [26,] 132(1923). J. G. P.

The physical properties of boric oxide containing glasses and their bearing on the general problem of the constitution of glass. S. ENGLISH AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **7** [26], 155(1923); see *Ceram. Abs.*, **2** [12], 275(1923).—Measurements were made of the thermal expansion, the refractive index and dispersion of two series

of sodium borosilicates, the first series contg. approx. 20% of sodium oxide, the second 10%. In each case the silica present was progressively substituted by boric oxide until in the 20% Na_2O series as much as 43.7% B_2O_3 was present, and in the 2nd series 46.07%. Results show that the linear relationships between chem. compn. and phys. properties, which had been found to subsist over a considerable range for many types of glasses, do not hold in the case of the sodium borosilicate glasses. Minima occur in the thermal expansion curves, and max. in the case of the density and refractive index, as also in the case of the annealing temp. The detd. results on thermal expansion show that Winkelmann and Schott's thermal expansion factors clearly do not hold for the boric oxide glasses, except over a very limited range. On practical grounds, the value of boric oxide for the prepn. of glasses of low thermal expansion is shown to be limited, since beyond a certain amt. the expansion increases instead of decreases. Various theories are discussed to explain the special results obtained in the case of the boric oxide glasses.

J. G. P.

Stainless steels from the point of view of the glass industry. W. H. Hatfield. *Jour. Soc. Glass Tech.*, **7** [26], 142(1923).—The properties of the various types of stainless steels were examd. The strength of stainless steel, as detd. on the tensile testing mach., varies according to the compn. and to the deg. to which the temp. is drawn, from above 100 T. per sq. in. breaking load in the hard condition, down to 30 to 40 T. per sq. in. when fully tempered. A specimen series of figures, obtained with a steel contg. 0.30% of carbon, is given. The mechanical properties of stainless steel in the hardened and slightly tempered condition were detd., and lab. tests in full details are given. Fatigue tests were also carried out on stainless steel in the hardened and slightly tempered condition, and results are given. Tests on stainless steel at high temps. show that it maintains its strength to a much greater degree than ordinary structural steel and may, therefore, be employed with advantage where parts have to withstand stress at temps. above normal. Tests on hardness as affected by increasing temps. were made and the results indicate that the energy absorbed is not substantially modified until temps. approaching 600° are attained. Tests performed up to 1000° on mild steel, alloy steels, tungsten steels, and stainless steels showed that the stainless steel scaled less than any of the others. The microstructure of stainless steel is described and its general phys. properties are given.

J. G. P.

A rapid method of testing the durability of glassware. H. S. Blackmore, Violet Dimbleby and W. E. S. Turner. *Jour. Soc. Glass Tech.*, **7** [26,] 22(1923).—An investigation is conducted on the suitability of a soln. of narcotine hydrochloride for testing the durability of glassware. A description of the test is given. *Conclusion:* The narcotine hydrochloride test applied under the conditions outlined in the paper is quite a satisfactory method of testing rapidly the durability of glass towards water.

J. G. P.

A study of the melting and working properties of boric oxide glasses, with special reference to the borosilicates. Violet Dimbleby, F. W. Hodkin, M. Parkin and W. E. S. Turner. *Jour. Soc. Glass Tech.*, **7** [26], 80(1923).—A discussion. J. G. P.

Tank furnace works organization. T. C. Moorshead. *Jour. Soc. Glass Tech.*, **7** [26], 105(1923). J. G. P.

Organizing for production from pot furnaces. W. W. Warren. *Jour. Soc. Glass Tech.*, **7** [26], 83(1923). J. G. P.

Investigation of pot-attack. W. Rosenhain. *Natl. Phys. Lab.* (Rept. for 1920, 124 pp.).—Further study of pot-attack shows that convection currents caused by temp. differences between top and bottom of pot are a factor which may disguise the convection currents set up by changes in density. It is suggested that maintaining the top of the pot at a higher temp. than the bottom will minimize the attack. E. S.

Determination of the viscosity of glass. W. ROSENHAIN. *Natl. Phys. Lab.* (Rept. for 1921, 186 pp.).—The viscosity of glass at temps. from 400°C to 700°C has been detd. by measg. the rate of twist under a known torque of rods of the glass in question. E. S.

Some phenomena of pot-attack. W. ROSENHAIN. (Collected Researches.) *Natl. Phys. Lab.*, **15**, 112–32(1920); *Trans. Soc. Glass Tech.*, **3** (1919).—The depth of attack by molten glass on the walls of a pot or on a clay rod inserted in the glass, increases in linear reln. with the distance below the surface of the glass. This is shown to be due to circulating currents set up by the decrease in density of the glass caused by soln. of the clay at the surface of contact resulting in unsatd. glass striking the bottom of the pots. The same phenomenon, occurring locally in small pits results in the "drilling" of pots. In the case of soln. by water these phenomena are generally reversed because the solutions are denser than the solvent, but with org. solvents they can be duplicated exactly. In the case of glass it is possible to control the currents and shift the zone of "drilling" by the use of a protecting ring of inert material, *e. g.*, zirconia. The rate of attack increases with the temp. The use of the X-ray is advocated for the detection of iron specks, air cavities, etc. E. S.

The casting of pots for experimental work on optical glass. ALICE B. TAYLOR. (Collected Researches.) *Natl. Phys. Lab.*, **16**, 289–98(1921); *Trans. Soc. Glass Tech.*, **4** (1920).—In casting pots, if the slip is too thin, the grog separates, while, if it is too thick, bubbles are trapped. These difficulties are overcome by rapidly filling the mold with slip under an air pressure of 20 lbs. per sq. in. Good results are obtained only in a narrow range of viscosity. E. S.

Chemical resistance of glass for the laboratory. A. MAURI. *Giorn. Chim. ed Appl.*, **5** [10], 495(1923).—Jena, Murano and Pyrex glass were investigated by treating with H_2O for a week, boiling H_2O for 3 hr., in H_2O at 134°C for 3 hr., 2 *N* H_2SO_4, boiling 2 *N* HCl, 2 *N* NaCl, 2 *N* NH_4Cl, *N*/10 NaOH, *N*/10 Na_2CO, 2 *N* NH_4OH, *N*/1 Na_2S. The Na_2S affected the glass the most. Jena and Pyrex lost nearly same wt. while Murano was less affected in all cases. H_2O, H_2O boiling 3 hr., 2 *N* NH_4Cl, and 2 *N* NaCl had no effect on the samples. S. S. C.

Measurements on the gases evolved from glasses of known chemical composition. J. E. HARRIS AND E. E. SCHUMACHER. *Bell System Tech. Jour.*, **2**, 122–32(1923).—Six kinds of glass were used, representing soda-lime, soda-potash-lead (lamp glass). and borosilicates of lead and soda. The specimen was placed in a container made of the same glass, and heated as close to the softening range as it was possible to go without causing the container to collapse. The gases driven off were examd. and classified as follows: (*a*) gases condensable above −78°C, (*b*) condensable between −78°C and 190°C (*c*), not condensable at 190°C, these fractions representing (*a*) water vapor, (*b*) carbon dioxide, (*c*) permanent gases: oxygen, nitrogen, hydrogen. The H_2O vapor was removed by surrounding the condensation trap with a mixt. of frozen and liquid acetone, and the CO_2 with liquid air. A McLeod gage was used to meas. the pressure of the evolved gases, and from the pressure the vol. was computed. It was found that at 200°C, the evolution of gas reached a max. for most specimens, thus proving that the adsorbed gas is driven off at that point. For the borosilicates, this point was 300°. Near the softening point (400°C for most specimens, 600° for Pyrex), the evolution of gas increased, this representing absorbed as well as adsorbed gas. The data shows a parallelism between per cent $Na_2O + K_2O$ and vol. of adsorbed CO_2, which would indicate that adsorbed CO_2 is held by primary valence forces. It would seem that CO_2 is taken up by a film of NaOH formed by slow hydrolysis of the glass. In general, glasses running high in alkali give off more water vapor as well as CO_2 than do those of lower alkali content. By subjecting glass to a heat treatment of between 1500° and

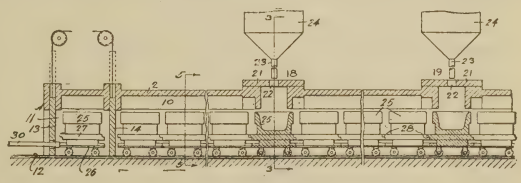
1600 °C for one hour, the absorbed gases were practically eliminated, as shown by the small amt. of permanent gases obtained on the test, whereas H_2O and CO_2 remained as adsorbed gases. The conclusion is drawn that glass relatively free from absorbed gas can be produced by htg. the glass during the melting process to a sufficiently high temp. The greater viscosity of the borosilicates makes it more difficult to render them gas-free. A. F. G.

Silica glass or fused quartz. ELIHU THOMSON. *Gen. Elec. Rev.*, **26**, 68–74(1923).—Historical account of manuf. of fused silica, with special ref. to author's patented elec. fur. process. Of particular interest are the illust. which include photographs of telescope reflector disks of clear quartz 1 ft. in diam., and large strain insulators of opaque quartz 10″ in diam. Stress is laid on the peculiar advantages offered by fused silica, due to its extremely low expansion: It is possible to figure an optical surface of quartz without affecting the curvature by the heat of polishing; a reflecting telescope with quartz mirror would show no distortion under irregular htg., which is a serious defect of glass reflectors; quartz can be shaped by grinding whereas glass would be cracked by the ht. developed. Due to its high m. p., metals can be cast into recesses or holes in the quartz, without shattering the latter. A. F. G.

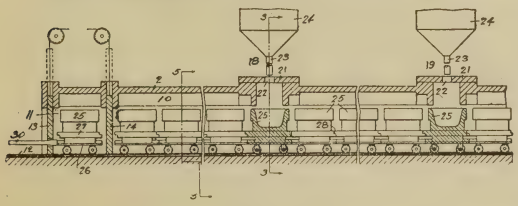
The manufacture of glass marbles. C. J. STAHL. *Glashütte*, **53**, 356–7, 371–2, 403–4, 419–21, 435–6(1923). J. B. P. (*C. A.*)

PATENTS

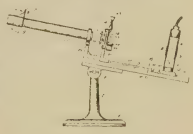
Method of melting glass in pots. FRANK E. TROUTMAN and CHARLES H. CHRISTIE. U. S. 1,476,431, Dec. 4. The method of melting glass in pots consisting in introducing the pots into a htg. chamber, moving the pots through said chamber, maintaining the temp. in said chamber as the pots move through same whereby the glass is melted and fined, and admitting batch to said pots at intervals in their passage through said heating chamber, the said pots being introduced into said htg. chamber and removed therefrom without exposing said chamber to the outer air.



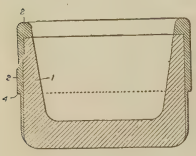
Glass-melting-pot furnace. FRANK E. TROUTMAN and CHARLES H. CHRISTIE. U. S. 1,476,432, Dec. 4. A continuous pot-fur. for melting glass having a plurality of moving carriers therein, means for charging batch into said pots at intervals in said fur., means for varying the temp. at different portions of said fur., and means for introducing the pots into said fur. and removing the pots therefrom without opening the htg. chamber of said fur. to the outer air.



Lens-testing instrument. WALTER C. SCHLITZER. U. S. 1,475,515, Nov. 27. A lens testing instrument comprising means for supporting a test lens, a lamp housing located on one side of said lens supporting means and having an opening at one side thereof, a sleeve adjustable on the housing and positionable over said opening, the sleeve having a light emitting opening that is adjustable to proper relationship with the test lens and acts to project rays of light onto the test lens, a sight

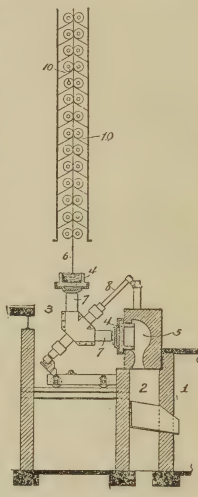


tube on the opposite side of the lens supporting means, an image screen within the tube, and a condensing lens between the image screen and lens supporting means.



Glass-melting pot. FRANK OSBORNE. U. S. 1,475,650, Nov. 27. An open top plate glass melting pot provided with an annular shoulder and having a body portion of pot clay, and a rim and an outer shell for the body portion of a clay which is more refrac. than that of the body portion, such shell extending down from the rim to a point below the shoulder of the pot.

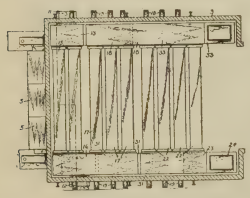
Art of drawing glass. HUGO J. WALTER. U. S. 1,475,527, Nov. 27. The improvement in the art of drawing glass sheets which consists in presenting charges of molten glass successively to a drawing app., drawing a sheet from each charge of glass, and causing each sheet drawn to serve as a bait for the succeeding sheet whereby the successive sheets will be welded together.



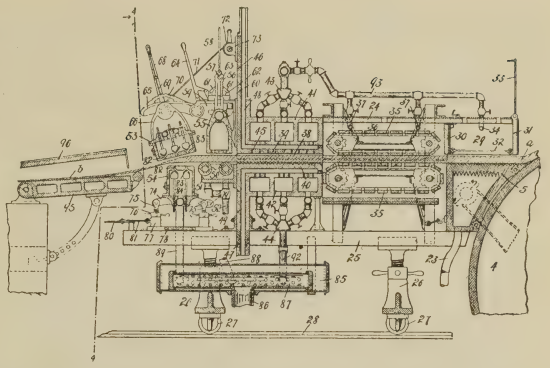
Arsenate of lime product and process of making same. LOUIS CHARLES DREFAHL. U. S. 1,475,545, Nov. 27. Process of making a stable, water-insol. arsenate of lime product which comprises pptg. calcium arsenate in a medium maintained at a temp. of from 120°F to 160°F.

Lens and blank therefor and method of marking it for the purpose of identification. THEODORE B. DRESCHER. U. S. 1,475,473, Nov. 27. A transparent refracting lens of glass having a portion of the mat. of which it is composed slightly modified or altered in the form of a designating mark less in area than the surfaces thereof, said marking or tinting extending through the lens from one surface to the other. The herein described method of marking glass lenses and blanks therefor for identification purposes consisting in slightly altering or modifying the glass of which they are composed from one surface to the other in definite designs by subjecting limited portions thereof corresponding to the design desired, to the rays projected from an electrically excited vacuum tube, the duration of the exposure being only sufficient to render the design perceptible but without appreciably affecting the light transmitting or refracting powers of the lens or blank.

Leer. GEORGE W. BATCHELL. U. S. 1,473,897, Nov. 13. In a leer, a plurality of flues, a gas inlet for permitting gas to enter the flues, the flues interconnected to form a continuous passageway for the gas through the leer, a burner located at one end of the connected flues, air inlets located at the ends of the flues to draw the air into the flues in the direction that the flame from the burner is moving to maintain the flame and the combustion of the gas as it progresses through the flues. In a leer, a plurality of flues, a gas inlet for permitting gas to enter the flues, the flues divided into sets of parallel connected flues, the sets of flues interconnected to form a continuous passageway for the gas through the leer, the number in each set increasing progressively towards the stack end of the leer.

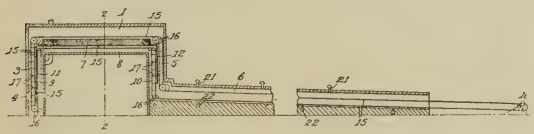


Method and apparatus for forming glass. ROBERT M. CORL. U. S. 1,474,019, Nov. 13. The method of forming glass, which consists in flowing a continuous column from a source of molten glass, progressively cooling the column below the point where gravity will vary its cross-section, progressively melting the advance end of the cooled column in such a manner that the melted portion will flow over the cooled portion and

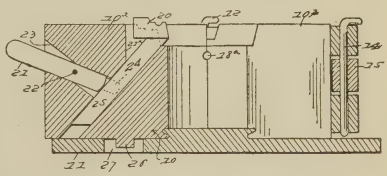


vary the cross-section of the column and allowing the glass to set in the cross-section resulting from such flowing. See *Ceram. Abs.*, **2** [11], 249 (1923).

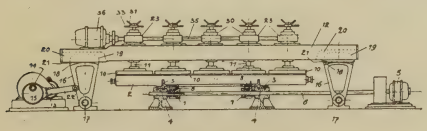
Leer for annealing glassware. DAVID STENHOUSE. U. S. 1,474,058, Nov. 13. A leer for glassware, comprising a horizontally disposed main annealing chamber of substantial length, said chamber having ascending and descending legs communicating with its opp. ends and being located at a relatively great elevation whereby is created a natural seal for confining ht. thereto, the ascending leg having a charging opening therein adjacent to its lower end, and an approx. horizontal cooling chamber communicating with said descending leg, and an endless ware conveyor arranged for advance travel from the charging opening to and through said cooling chamber and for return travel throughout a path in which its temp. is raised to the required point by absorption of ht. given off by the ware and the leer walls.



Glass mold. JOHN G. MORITZ. U. S. 1,474,329, Nov. 13. A molding app. of the type indicated having a section or mold body and a ring or cap provided in their contact faces with complemental registering channels combining to form a handle mold in communication with the interior of the receptacle mold, and means for upwardly deflecting the molded handle after the completion of the molding operation and consisting of a lifter block movable with relation to and carried by one of the mold sections.



Apparatus for grinding, smoothing, and polishing glass, plate glass, and other material substances. CHARLES HEUZE. U. S. 1,474,672, Nov. 20. App. of the character described, comprising a table for supporting the work; a succession of rows of tools extending above and across the table, each row having an individual support; mechanism for imparting an endwise reciprocating bodily movement to all of said supports simultaneously, but moving the odd-numbered supports in one direction and the even-numbered supports in the opposite direction; and mechanism for rotating all of the tools of a row simultaneously. Apparatus of the character described, comprising a table for supporting the work; a succession of rows of tools extending above and across the table, each row having an individual support; mechanism for imparting an endwise reciprocating bodily movement to all of said supports simultaneously, but moving the odd-numbered supports in one direction and the even-



numbered supports in the opposite direction; and mechanism carried by and individual to each support for rotating all of the tools in the corresponding row simultaneously.

Heavy Clay Products

House insulation and fuel consumption. H. J. Burt. *Concrete*, **23**, 117–18(1923).—Insulating lumber is supplied in sheets and replaces lath. The unit B.t.u. ht. loss for 1 in. thickness is given: insulating lumber, 0.33; wood sheathing, 1.25; plaster, 1.50; brickwork, 4.00; concrete, 6.00. By the addn. of insulating lumber to ordinary forms of wall construction there is a ht. saving of from 30 to 40%, which the author claims should result in at least 25% fuel saving in residence construction. F. T. H.

Fire-resistive houses a reality. Wharton Clay. *Arch. Forum*, **39** [4], 33 (1923).—The Underwriters' Laboratories have announced that a wood-studded partition plastered on both sides by metal lath and plaster, and an ordinary wood-stud floor as commonly constructed, but protected on the under side with metal lath and plaster, will resist the intense ht. of their standard fire test for over one hr. and remain intact and carry its load beyond that period. They claim that ordinary lath and plaster will expose the wood behind, under the same conditions, in about 4 min. F. T. H.

Study effect of moisture on concrete slabs. Anon. *Cement & Eng. News.*, **35** [9], 30(1923).—Progress report of tests being conducted by U. S. Bureau of Public Roads, in conjunction with Eng. Exp. Sts. of Purdue Univ. Moisture, like heat, sets up internal stresses which probably tend to aid failure of concrete roads. Freezing of this moisture produces still greater stresses. 75 slabs are being tested in a specially constructed testing machine, in which alternate transverse failure occurs in less than two minutes. F. T. H.

Standard sizes for cement block and brick. Anon. *Concrete*, **23**, 162(1923).—Concrete brick to be the same as adopted for clay face brick: rough $2^1/_4$ x $3^3/_4$ x 8 in.; smooth, $2^1/_4$ x $3^7/_8$ x 8 in. Tentative standard sizes for concrete block and tile: Foundation concrete units: height $7^5/_8$ in., length $15^5/_8$ in. Wall thicknesses, 8 and 12 in. (thickness of units); load bearing wall concrete units, height $7^5/_8$ in., length $15^5/_8$ in. Wall thicknesses, 6, 8, 10 and 12 in.; load bearing wall concrete structural tile, height 5 in., length $11^5/_8$ in.; wall thicknesses, 4, 8 and 12 in.; concrete partition tile, height $7^5/_8$ in., length $15^5/_8$, 18 and 24 in.; wall thicknesses, 3, 4, 6 and 8 in. F. T. H.

Fire tests of brick walls. S. H. Ingberg. *Amer. Arch.*, **124**, 307–18 and 355–62 (1923).—*Scope of tests.* A rept. of a part of a program of tests to det. the effectiveness of brick walls as fire barriers and to obtain definite knowledge of their ht. insulation and stability under fire conditions. The series includes fire endurance tests and fire and water tests with 2 types of surface clay brick, 1 shale, 2 sand lime brick and 1 Port. cement brick. Auxiliary compressive, transverse and absorption tests were also made. (1) *Test specimens and construction details.* The test walls built on contract based on competitive bids to obtain representative workmanship were 11 ft. high and 16 ft. wide, being contd. in movable frames placed for test to form one side of the test fur. Some panels were restrained and some were unrestrained to represent varying conditions of use. Further tests of walls under load are to be made. (2) *Testing methods.* The fire exposure is obtained with oil burners and is regulated to conform to a predetd. time-temp. reln., 1700°F in 1 hr., 1850°F in 2 hrs., and 2150°F in 6 hrs. Temperatures in the fur., in the wall and on the unexposed side of the wall are measured by the thermo-elec. method. Six hrs. was the limit for the endurance test. In the fire and water test the wall was exposed to the fire for 1 hr. and then to a hose stream from a $1^1/_8$ in. nozzle under 50 lb. per sq. in. water press. was applied. (3) *Test charac. and results.* (*a*) *Deformation and cracking.* The first visible ht. effects were deflections toward the fire. Cracking along mortar joints and through brick were next noted. In

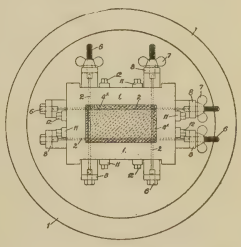
point of freedom from cracking the bricks in the series can be roughly placed in the following order: Eastern surface clay, Western surface clay, concrete, sand-lime and shale. (*b*) *Heat effects.* The first indication was issuing of steam from free water from open or imperfect mortar joints. The time required to reach on the unexposed side a temp. of 150°C (302°F), the danger point for hazardous occupancies varied from 1 hr. 25 min. with 4-in. walls to over 6 hr. with some 8-in. and all 12-in. walls; 250°C (482°F), the danger point for non-hazardous occupancies was reached in less than 6 hrs. by the hollow 8-in. walls and by the 4-in walls. The final temp. at 6 hr. varied from 83°C with the 12-in. walls to 252°C with the 8-in. hollow walls. (4) *Conclusions.* From a study of the condition of the tested walls, the deflections and the temp. reached Ingberg gives the fire resistance periods of brick walls as follows:—

Thickness	Type	Interior structural members framing into wall	Materials protected	Load on wall	Fire resistance period
4-inch	Solid	Incombustible and fire resistive	Non-hazardous	Non-bearing	1 hour
8-inch	Solid	Incombustible	Non-hazardous	Non-bearing	4 hours
8-inch	Solid	Incombustible	Hazardous	Bearing or non-bearing	2½ hours
8-inch	Solid	Combustible	Hazardous or non-hazardous	Bearing or non-bearing	1½ hours
8-inch	Hollow	Incombustible and fire resistive	Non-hazardous	Bearing or non-bearing	2½ hours
8-inch	Hollow	Incombustible and fire resistive	Hazardous	Bearing or non-bearing	1½ hours
8-inch	Hollow	Combustible, on one side only	Hazardous or non-hazardous	Bearing or non-bearing	¾ hour
8-inch	Hollow, filled solid at floor lines	Combustible or incombustible	Hazardous or non-hazardous	Bearing or non-bearing	1½ hours
12- or 13-inch	Solid	Combustible or incombustible	Hazardous or non-hazardous	Bearing or non-bearing	4 hours
12- or 13-inch	Hollow	Incombustible and fire resistive	Hazardous or non-hazardous	Bearing or non-bearing	4 hours
12- or 13-inch	Hollow	Combustible	Hazardous or non-hazardous	Bearing or non-bearing	2 hours
12- or 13-inch	Hollow, filled solid at floor lines	Combustible or incombustible	Hazardous or non-hazardous	Bearing or non-bearing	4 hours

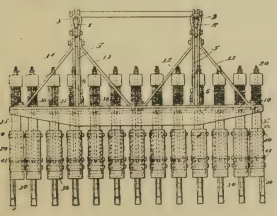
H. D. F.

PATENTS

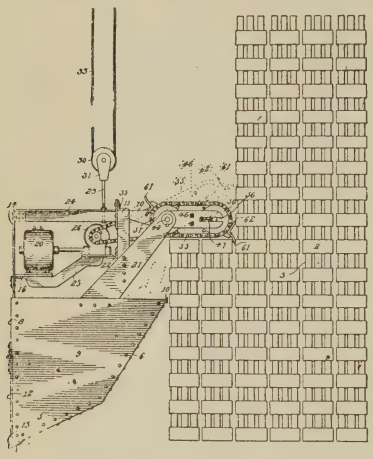
Manufacture of bricks. Frederic P. Jones. U. S. 1,475,832, Nov. 27. The manuf. or production of bricks or blocks of the kind referred to, characterized by sepg. an unbroken slice of the full surface dimensions from the formed body and then reuniting the severed slice to the body by a pressing means capable of simultaneously ornamenting the surface of the slice.



Brick-handling fork. William W. Wallace. U. S. 1,474,806, Nov. 20. Brick handling app. of the kind described, comprising an overhead support, a plurality of horizontally extending brick engaging fingers and means connecting said fingers and said support consisting in a vertical bearing rigidly attached to said frame, a carriage adapted for vertical sliding movement on the bearing member and carrying the horizontal fingers, anti-friction



members between said carriage and said bearing and positive stop means coöperating with said anti-friction members to limit the vertical movement of said carriage.



Apparatus for removing burnt brick from a kiln, stack, pile, or the like. ALEXANDER A. SCOTT. U. S. 1,474,793, Nov. 20. Apparatus of the kind described, comprising a brick-carrying receptacle, means coöperating with said receptacle to extend therefrom, and engage the rows of brick remote from said receptacle, said engaging means constituting brick removing means to transfer brick from a stack to the receptacle, and including an endless conveyor, having brick moving devices thereon, said endless conveyor being arranged for variable vertical positions with regard to the brick.

Refractories

Bauxite and aluminum in 1922. JAMES K. HILL. *U. S. Geol. Surv.* (Mineral Resources of the U. S.), [1], 87–96(1922).—The domestic production of bauxite increased 122% in 1922 over 1921. The amt. produced was not as great as in 1920. The increase in the eastern fields showed a revival of the aluminum salts indus. The main producing states for bauxite in 1922 were Ark. and Ga. In the last few yrs. high alumina clays have been substituted for bauxite in mfg. refrac. The main source of these clays is Mo. Three grades of clay contg. 55%, 65% and 75% Al_2O_3 are regularly handled. The U. S. produces more bauxite than the rest of the world. The diaspore deposits of Mo. are being rapidly developed. 40,000 tons of diaspore clay were sold to consumers. Diaspore in cryst. form is of commercial interest. Diaspore can probably be used for the manuf. of abrasives and aluminum salts. Kyanite, sillimanite and andalusite, aluminum silicates containing more than 60% Al_2O_3, can probably be substituted in some cases for diaspore and bauxite. Large deposits of kyanite have been discovered in Wyo. and Ariz. Alunite is being mined and treated in Utah for potash. Some of the by-product Al_2O_3 is being used for the manuf. of refrac. Some data are also given on the production and consumption of bauxite for the various industries. T. N. McV.

Lining acid electric furnaces. J. M. QUINN. *Iron Age*, **111** [16], 1101–2(1923).—Careful selection of mat. for lining an acid elec. fur. is essential. Two grades of ganister are available, crushed and ground. The former is $^1/_2$ in. mesh with 50% smaller than $^3/_8$ in. The latter is $^1/_4$ in. mesh with a large propn. of fines. Crushed ganister is the more refrac. of the two. Silica sand may also be used. Glutin, molasses and water glass are used as binders with these mat. Silica brick are very satisfactory for linings. The best method for lining an acid fur. is to use high grade silica brick for the bottom and side walls. The brick should be laid dry, leaving room for expansion. The fur. should be heated up gradually until the brick just begin to melt. The bottom should be burned in layer by layer with moistured silica sand. The cup shaped bottom is preferred to the saucer shaped. A fur. can be lined at less expense by using rammed-in ganister instead of silica brick. Directions are given for ramming in the ganister lining and burning it in. Silica brick are usually used in the roof. The author advises against the use of insulation. M. E. M.

Acid electric steel furnace operation. J. M. QUINN. *Iron Age*, **111** [17], 1177–9(1923).—The scrap charged should be slightly below the max. limits for sulphur and

phosphorus, and not too high in carbon. Charge all the scrap at one time, placing large pieces and those highest in carbon on the bottom. With very rusty scrap, free from sand, some silica sand should be shoveled in to prevent the charge attacking the lining. It is possible by careful melting and selection of scrap, to have completely deoxidized metal in 10–15 min. If trouble occurs, and the first test shows carbon over 1%, it is well to pig the heat. If it is decided to work the heat, ore or scale is added carefully, to decarburize the metal. The black oxidizing slag remaining should be removed from the fur. if of large vol., and a new slag made of clean silica sand. While the slag is black both it and the metal contain oxides, which must be reduced. This is done by throwing fine coal or coke on it. Some SiO_2 is reduced under the arc, the nascent Si produced helping to deoxidize the steel. Other reducing agents sometimes used are ferrosilicon, ferromanganese, aluminum, and lime. When the metal is completely degasified, the alloy additions made, and the correct temp. reached, it should be poured from the furnace quickly, as any delay will make a thick, unwieldy slag. M. E. M.

Effect of carbon monoxide on refrac. ANON. *Metal Industry* (London), **23,** 472(1923).—Large scale expts. with electro-thermic dry distillation process for treatment of zinc ores recently undertaken by Mississippi Valley Expt. Station of the U. S. Bureau of Mines have been hampered by rapid disintegration of condenser linings of ordinary fire brick. This disintegration was due to the action of carbon monoxide which caused increase in volume of the brick by deposition of carbon around iron oxide particles in the refrac. mat. Disintegration was avoided by the use of iron-free refrac. mat. R. J. A.

Dolomite for refractories. ANON. *Metal Industry* (London), **23,** 460(1923).—Research work on the utilization of dolomite in refracs. is being continued by U. S. Bureau of Mines at Columbus, Ohio. The main problem being studied is to combine the lime in dolomite so it will be non-slaking and at the same time hold up the refracs., thereby rendering available abundant deposit of dolomite for use as a basic refrac. Previous work has indicated that one of the best fluxes is alumina-iron flux. More recent work has consisted in slaking lime tests on varying proportions of dolomite and alumina-iron flux; 5 to 50% of flux was used and the refrac. properties as well as slaking tendencies were studied. After the best propn. was detd. bricks were made and the proper firing procedure then studied. As a result, a compn. has been found which, when compounded with proper binder and properly burned, produces a strong non-slaking brick of high refractoriness. The bricks are satisfactory except that uniform shrinkage has not been completely attained. R. J. A.

Refractories for the aluminium industry. R. J. ANDERSON. *Metal Industry* (London), **23,** 441–2(1923).—(Abstr. of paper before Refrac. Division, AMER. CERAM. SOC.) A. discusses refracs. for melting substantially pure aluminium and aluminium alloys, both from the point of view of the setting for furs. and use as the containing vessel or hearth. While req. melting temps. are low, the corrosive action of liquid aluminium is great, causing failure of refracs. Carbon is used for lining furs. for the electrolytic reduction of primary aluminium. This is remelted for pigs or ingots in reverberatory type furs. Reverberatory fur. with high-grade fire brick lining are usually employed in rolling-mill practice for melting substantially pure aluminium. Alloys are usually melted in iron-pot or crucible furs. unless production is large, when reverberatory fur. are used. The various types of furs. used in light-alloy foundry practice are discussed. The iron-pot fur. is most favored; in this, the shell is lined with fire brick and the alloy melted in a cast-iron vessel, usually made of ordinary gray foundry iron, but sometimes of a mixt. of 40% semi-steel and 60% foundry iron. The av. life is about 40 heats. Further research is needed on question of refracs. and contg. vessels for melting in die casting and permanent-mold casting practice. Present iron-pot methods are not satis-

factory owing to dissolution of iron. Alundum linings are not successful. The linings for furs. in secondary smelting of aluminium and aluminium alloys is an important factor. The life of fur. linings in secondary work is low owing to local burning. Reverberatory, crucible and iron pots are used, and requirements are severe owing to the high temp. generated by the oxidation of aluminium and the use of fluxes which are destructive to linings. R. J. A.

The commoner refractories. C. E. Moore. *Metal Industry* (London), **23,** 458 (1923).—(Abstr. of paper before Birmingham Met. Soc.) M. calls attention to the dangers arising from vol. changes in fire bricks at different temps., involving buckling of arches in furs. The conversion of quartz in silica brick is much more slow than in ganister, but silica brick requires very careful treatment during htg. and cooling; it does not usually deform until 1500° is reached. An increasing amt. of semi-silica bricks contg. 80% silica is being used, which are very suitable for some purposes; these are being employed to an increasing extent in the U. S. for coke ovens. An efficient refrac. must resist slag action and compression at alternation of temp., and must also stand up well to cutting flames and gas impact. It is important to use the highest temp. possible in manuf. of bricks so that failure in use at high temps. may be prevented. In the U. S. where the use of oxygen is desired for fur. work, the greatest difficulty is to find refrac. to withstand much higher temps. which the employment of oxygen involves. R. J. A.

The care of brass foundry crucibles. C. F. Hopkins. *Metal Industry* (London), **23,** 459–60(1923).—(Abstr. of paper before Phila. Foundrymen's Assoc.) H. discusses the storage, drying, and annealing of brass-foundry crucibles, and their treatment in the fur. Instances are cited where proper annealing markedly increased the life of crucibles. It is pointed out that handling of crucibles, in many foundries, before being used, is bad. The effect of furnace design upon crucible life is discussed. Methods of handling crucibles are taken up, and sketches illus. correct and incorrect methods of handling with tongs. Crucible life is greatly affected by rough and improper handling R. J. A.

Preparation of super-refractories. Anon. *Metal Industry* (London), **23,** 465 (1923).—Work on the development of refracs. from artificial sillimanite is in progress at U. S. Bureau of Mines, Northwest Experiment Station, Seattle, in coöperation with ceram. trade interests. The best compd. found is one a little richer in alumina than pure sillimanite. R. J. A.

Graphites for brass melting crucibles. R. T. Stull and L. E. Geyer. *Metal Industry* (London), **23,** 466(1923); also *The Metal Industry* (N. Y.), **21,** 477–8(1923); (Abstr., U. S. Bur. Mines, *Rept.* **25,** 42(1923).)—Tests on bond clays had previously indicated that Mo. pot clay and Ill. kaolin were better than Klingenberg clay. Tests were next made to det. the value of American graphites for crucible making as compared with foreign ones. Mo. pot clay was used, and crucibles were made up with graphites from various domestic sources, and with Can., Ceylon, and Madagascar graphites. These crucibles were then tested in brass melting practice, and record kept of the failures. The most frequent cause of failure was pin holing, which usually developed at, or below, the slag line. Cracking was also a prominent cause of failure. The crucibles made of domestic graphite compared well with those made of the foreign. R. J. A.

Durability of refractories. W. J. Rees. *Metal Industry* (London), **23,** 414–5 (1923).—(Abstr. of paper before Birmingham Met. Soc.) The selection and use of refrac. mats. cannot be placed on an adequate basis until phys. and chem. properties can be specified and tested in measurable quantities; this necessitates a clear understanding of the conditions that the mats. are called upon to meet. Failures of refrac. mats. are placed in 4 classes; *viz.*, (1) unsatisfactory qualities including lack of uniformity; (2) faulty selection; (3) faulty treatment due to accidents, carelessness or ignorance; and

(4) absence of factor of safety. Failures under the first two classes should be capable of being completely eliminated and those due to faulty treatment capable of elimination to a marked extent by proper training or a bonus to operators, based on the life of refracs. or pots. Durability is dependent upon 9 factors; *viz.*, (1) softening temp.; (2) mech. strength at normal and high temps.; (3) thermal or reversible expansion; (4) permanent expansion or contraction; (5) resist. to abrasion; (6) resist. to slag attack; (7) permeability to gases and vapors at high temp.; (8) resist. to abrupt changes in temp.; and (9) changes in properties after prolonged heating. In modern by-product coke ovens the mech. strength of silica bricks at high temps. is a consideration of importance to oven builders. The amplification of existing tests and provision of others is desirable Many structures collapse through careless heating and the use of unsuitable cements. Av. durability of refracs. is greater than formerly owing to scien. investigations, but good practice will be greatly promoted by close collaboration between makers and users. R. J. A.

An examination of refractories by the oxygen blow pipe. ALGERNON LEWIN CURTIS. *Trans. Ceram. Soc.*, **22** [2], 199(1922–23).—It is sometimes necessary to exam. quickly the refrac. qualities of raw mats. and to compare different mats. one with another during examn. In the ordinary method of test a prospective refrac. undergoes ultimate chem. anal., and if then considered satisfactory cones of the mat. finely ground are made up and exposed to varying temps. The result of such tests gives a percentage of total fluxes, and a number of distorted test pieces, which have undergone more or less change, according to the temps. at which they were exposed. Although the above combination of tests is an efficient one, the time and expense necessary to carry it out render large numbers of such tests a big undertaking. In order to save time when examg. small amts. of refrac. mat., a method was adopted for bringing into use the oxygen-coal-gas-blowpipe. The test piece was exposed to a strong fixed blowpipe flame and test pieces of a briquette nature were used. A camera was thought necessary. A crude wooden stand was improvised to carry the camera and span the lath bed holding the test piece. The idea was to mount in a microscopic table, in place of an Abbé condenser, a tube carrying a short focus telescopic objective of high order. A series of graduated diaphragms was provided in this tube. The function of the telescopic objective and diaphragms was to project an air image of part of the illumined test piece to the plane of the stage of a microscope. Instead of using a body tube in the microscope, a wooden front carrying a metal fitting was substituted, the wooden front forming part of the camera and the metal fitting for a microscopic objective. By inserting a microscopic objective in a metal fitting this objective became a photographic objective, and the air image projected by the telescopic objective became magnified by it, focusing being carried out with the ordinary rack mechanism of the microscope. The camera was designed to give suitable extensions and consequently increased magnification. In making a survey of the whole test, representing 56 test pieces from 7 different mats., and 7 pieces of Seger cones, it was seen that "surface attack" from heat and shrinkage could be readily studied; and those materials first affected by ht. are inferior to mats. which resist attack to the last. The best bauxitic clay tested was less liable to ht. attack than the Scotch fire clays, besides possessing less shrinkage. A distinct difference in quality of such bauxitic clays can be assumed from the difference shown in the heat attack of the three test pieces. Of the four Scotch fire clays, it was seen that one test piece had little claim to a place as a refrac. fire clay. The other fire clays can all claim to belong to the refrac. fire clay group, their chief detriment being high shrinkage. H. F. S.

Silica bricks for coke ovens. A. H. MIDDLETON. *Trans. Ceram. Soc.*, **22** [2], 169 (1922–23).—Under the foll. conditions, silica brick is recommended as a substitute for

quartzite: (1) In the case of new installations; (2) the renewal of walls where salty coal is used; (3) where ordinary coal is used, but the alterations or repairs are so extensive as to make it possible to alter the whole htg. arrangement as well as to replace the actual walls. The article points out briefly some of the advantages of a silica construction and deals in detail on one point in which silica bricks differ fundamentally from quartzite bricks, namely, their permanent expansion when heated to temps. at which ovens built of silica bricks are frequently operated. The raw mat. and the firing of the bricks are also discussed. H. F. S.

The behavior of fire clays, bauxites, etc., on heating. H. S. Houldsworth, and J. W. Cobb. *Trans. Ceram. Soc.*, **22** [2], 111(1922–23).—Kaolin, a Dorset ball clay, Farnley fire clay, a Scottish fire clay, and Ayrshire bauxite clay were examd. It appeared that 7 definite shrinkage points existed between 15–1100°C for kaolin, *viz.*, at 530, 625, 700, 880, 950 and 1060°C, the clay having a very small rate of contraction at intermediate temps. when subjected to a prolonged htg., but expanding (reversible thermal expansion) when the htg. was more rapid. The shrinkages at 625, 700, and 780, were considerably smaller than those taking place at 530, 880, 950, and 1060°C. For Farnley fire clay pronounced shrinkage points occurred at 540, 880, 950, and 1080°C together with a slight shrinkage about 100°C. These changes were irreversible, as is seen from the cooling curve, which, however, shows the contraction on cooling between 600°C and 550°C due to the inversion of β to α quartz. Atlas fire clay behaved very similarly to the Farnley fire clay, giving marked irreversible shrinkages at 100–140°C, 540, 880, 980, and 1050°C with a rapid reversible expansion between 575° and 610°C due to the inversion of the free α quartz of the clay to β quartz. It will be seen that Ayrshire bauxite clay, an aluminous clay, differed from the siliceous clays examd. both in possessing a larger number of shrinkage points, *viz.*, at 100, 530, 620, 700, 880, 950, and 1015°C, and also in the larger contractions which took place at these temps. The shrinkage of clays is not a continuous process but one which takes place in a number of stages, each stage being completed at a definite temp. The shrinkages of considerable magnitude are, generally speaking, found at almost the same temps. in the different clays. Some points, such as the absence of the 530°C shrinkage in ball clay, have no doubt a significance, but one which can not be explained at present. Kaolin and all the clays and shales examd. show distinct heat absorption at a temp. of 500–530°C and heat evolution at a higher temp. This heat evolution occurs at a temp. of 1060–1130°C with pure alumina made by calcining aluminum nitrate at 700°C, but at a temp. lower to an extent of about 100°C with the bauxites and clays, possibly on account of the impurities associated with the alumina in combination or some form of solution effective for the purpose. Most of the mats. show heat absorptions at temps. below 500°C, presumably due to the loss of water from colloid subs. The phenomena observed with the clays are not primarily dependent on the presence of silica. They are noticeable with alumina and with a red bauxite practically free from silica, though the ht. evolution then took place at a higher temp. For some reason, although alumina calcined at 700°C and the bauxites and clays show marked heat evolution at about 1000°C as noted above precipitated alumina gave no sign of it. It may be that the change responsible for the ht. evolution had occurred with the pptd. alumina before it was heated in our app., but that with aluminum nitrate, or silicate the presence of other mat. associated with the alumina deferred the change. H. F. S.

Heat insulating materials for electrically heated apparatus. J. C. Woodson. *Trans. Amer. Elec. Soc.*, **43**, 20 pp.(1923).—This paper is a general discussion of the subject. The author classifies processes into 5 temp. ranges between 0 and 1100°C and lists the insulating mats. applicable to each temp. range. The simpler formulas used in calcg. heat flow are given and discussed. Around 100 commercial insulating

mats. are listed with their important properties. All these insulators are made of about a half dozen different raw mats. in most of which the insulating property is caused by tiny entrapped dead air spaces in their structure. Larger air spaces between walls may tend to increase rather than decrease the heat loss, however, due to convection currents and radiation carrying the heat through them. Besides low heat condy., low sp. gr. and sp. heat, good mech. strength, etc., are desirable properties in insulating mats. In general, compared to electrical insulation our present mats. and data for applying them for the solution of heat insulating problems are still very imperfect. B. M. L.

Terra Cotta

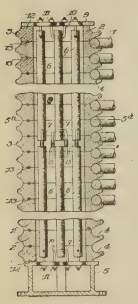
Industrial architectural practice. SYMPOSIUM. *Arch. Forum,* **39** [3], 83–151 (1923).—A whole number devoted to industrial architecture including following topics. Industrial architecture in concrete by CASS GILBERT. The choice of an industrial building site by MAURICE M. OSBORNE. General principle of planning. Choice of type of construction by JOHN R. NICHOLS. Fire prevention and protection and data on fire and accident prevention requirements by C. STANLEY TAYLOR. Roof types and roof surfaces by WALTER F. BALLINGER. Industrial flooring materials by CHARLES A. WHITTEMORE. Natural lighting by WM. R. FOGG. Welfare provisions by CHAS. L CLOSE. Plumbing by JAMES A. COTTER. Heating and ventilation by CHAS A. FULLER. Power provision and steam plant design by ALLEN HUBBARD. Artificial illumination by A. L. POWELL. Electrical power by JAMES A. MCHOLLAN. F. T. H.

Whiteware

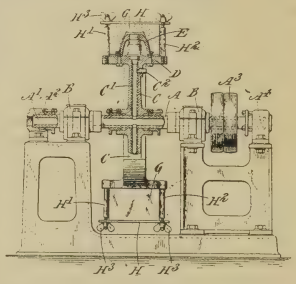
The production of porcelain for electrical insulation.—V. F. H. RIDDLE. *Jour. Am. Inst. Elec. Eng.,* **42,** 858–63(1923); see *Ceram. Abst.,* **2** [9], 199(1923); **2** [11], 258 (1923).—Methods of forming, drying and glazing the insulator shapes are described. Dust or semi-dry pressing is used on low-tension insulators such as switch bases, lamp sockets, etc. The dried filter press cakes are crushed, dampened, pulverized and pressed in steel molds. The density of this product is not so great as that formed from the plastic batch, but accurately sized, difficult shapes can be made. Throwing, jiggering and turning from pugged blanks are processes in which the body is shaped while in the plastic condition, and might be termed "plastic forming." Pieces formed in this manner are trued up while still damp but stiff enough to hold their shape. A special method in use at the author's plant for spark plug porcelains is known as dry process turning, and consists of revolving the bone-dry blank on a lathe, and facing it with a rapidly revolving grinding wheel. The drying shrinkage is eliminated by this process. The "hot press die" method is used on insulators with thin-walled petticoats. Here the plaster of Paris mold, having the shape of the outside or top of the insulator, is placed on a horizontally revolving wheel, the plastic clay being carefully pressed in so as to conform with the mold. A heated metal part is forced down upon the clay in the revolving mold, and shapes the spinning clay into proper form for the bottom of the insulator. The hot metal causes steam to be formed from the water in the plastic body, and this acts as a lubricant preventing the clay from tearing, and also making possible an extremely thin petticoat or wall. Casting from porcelain slip in plaster molds, a method widely used in the potteries, has been applied during the last five years to the forming of heavy insulators (high-tension). Density, uniformity and freedom from strain are the advantages conferred by this process. In the drying of elec. porcelain, modern methods of controlling humidity, temp. and circ. of the air, particularly as exemplified by the tunnel humidity drier, have reduced the time of drying of the larger pieces from weeks to days, and on all sizes of ware the losses have materially

decreased. Glazing of the insulators is described, and formulas given for a brown or "Albany slip" glaze and a clear white glaze. Low thermal expansion and high ht. condy. are valuable properties in both body and glaze, as they tend to minimize "crazing" and "shivering." In connection with glaze-fit, mention is made of the author's work on the application of tensile test specimens, in which it was clearly shown that when the expansion of the glaze departs considerably from that of the body, the tensile strength is less than normal. This may account for the failure of insulators in actual service, due to strains set up by fluctuations in temp. A. F. G.

PATENTS



Insulator. WALTER T. GODDARD. U. S. 1,474,256, Nov. 13. A column type insulator comprising a series of annular insulating units superposed one upon the other and each provided with a flange cut away to form a lip for receiving portions of successive convolutions of a conducting coil, interlocking means between adjacent units acting to prevent their relative movement, and tension rods formed of sections of insulating mat. and connecting the uppermost and lowermost units of the series and acting to hold all the insulating units in a state of compression.



Apparatus for casting or molding pottery and like articles. JOSEPH FORSYTH GIMSON. U. S. 1,474,432, Nov. 20. Apparatus for casting or molding pottery and like articles including in combination a hollow rotatable shaft, a hollow arm radiating therefrom and having its interior in communication with the interior of the shaft, an absorbent mold carried by the hollow arm, means for supplying the material to be treated to the interior of the shaft and thence through the hollow arm to the mold, and means for rotating the shaft, the moisture being removed from the mat. and absorbed into the mold under the action of the centrifugal force set up by the rotation of the app. as set forth.

Equipment and Apparatus

A new heat insulator, balsam-wool. HOWARD F. WEISS. *Concrete*, **23**, 149–50 (1923).—By disintegrating waste wood and rearranging the fibres so as to obtain a max. of dead air cells, there has been developed an insulating mat. which has a lower thermal conductivity than Balsa, the lightest natural wood. Thickness (inches) required to equal $^1/_2$ in. of balsam-wool: balsam-wool, 0.50; sheathing lumber, 1.58; common brick, 8.00; sheathing paper (solid), 1.59; lime plaster or stucco, 17.00. F. T. H.

A thermostat for moderate and high temperature. J. L. HOUGHTON AND D. HANSON. (Collected Researches.) *Natl. Phys. Lab.*, **15**, 53–65(1920); *J. Inst. Metals*, **14** (1915) and **18** (1917).—Describes an air bulb thermostat made of glass or fused silica, the expansion and contraction of the air making and breaking a mercury contact which operates a solenoid controlling the resistance in the fur. circuit. E. S.

A carbon tube furnace for testing the softening points and compressive strengths of refractories. E. GRIFFITHS AND E. A. GRIFFITHS. (Collected Researches.) *Natl. Phys. Lab.*, **15**, 19–28(1920); *Trans. Faraday Soc.*, **12**(1917).—A carbon tube resistance furnace packed with zirconia and magnesia using N to maintain neutral atmosphere. The load is applied by means of springs and transmitted to the specimen through a yoke and carbon block. E. S.

Pyrometer standardization. E. GRIFFITHS AND F. A. SCHOFIELD. (Collected Researches.) *Natl. Phys. Lab.*, **15**, 31–47(1920); *Trans. Faraday Soc.*, **13**(1919).—A review of the methods for standardizing various types of pyrometers. E. S.

An economical furnace for fusions. POZZI. *Corr. dei Cer.*, **4**, 10(1923).—A fur. constructed for the use of coal as a fuel in the smelting of frits working in a continuous manner. It is designed with a feed of the mix in at one side and the flow of frit out on opposite. The fur. requires but 300 kgs. of coal a day and the product is completely fused and the temp. possible to reach is 1300°C. The opern. is rapid and a regenerative system is used with a very economic production of smelter. No drawing of fur. given and no amt. of mat. produced. S. S. C.

The strong arm of industry. ANON. *Cement & Eng. News*, **35** [9], 26–9(1923).—A discussion of modern power shovels, giving opinions on relative merits of steam, elec. and gasoline-elec. types. It is conceded that elec. and gasoline-elec. are most economical and advantageous for small installations, while steam is still best type for the larger shovels. F. T. H.

Automatic burner control. ANON. *The Foundry*, **51** [23], 968(1923).—Describes the F. J. Ryan & Co. automatic temp. control for oil and gas fired fur. The unit consists of a valve operg. in conjunction with a magnet, the movement impulse originating in a thermocouple within the htg. chamber, and connected through a recording pyrometer and control panel. It is adaptable to high or low press. burners. Illus. M. E. M.

Experimental study of ball-mill grinding. D. H. FAIRCHILD. *Eng. & Min. Jour. Press*, **116** [20], 845–6(1923).—F. studied the action in ball mills with heavy glass end plates by observation and by motion pictures. The factors in ball-mill action are impact crushing, attrition and dead wt. Impact crushing is by far the most important. In the usual ball mill of circular section this action takes place largely only in the upper surface zones of the charge, with large zones at the center and next the walls comparatively inactive. The circular section gives little wear on linings and best distribution of loading, but varied forms may be developed that will cause "a more rapid change of mill content" and "more effective agitation within the ball mass." B. M. L.

Rubber lining for ball mills. A. B. PARSONS. *Eng. & Min. Jour. Press*, **116** [12], 489–90(1923).—Originating in observation of the remarkable wearing power of automobile tires over rocky roads, the idea of using similar rubber linings for ball mills has been developed and applied successfully at the Nipissing Mining Company's plant near Cobalt, Ontario. The idea has been patented. The rubber used is not hard but rather soft, tough and well vulcanized. A 4 x 20 ft. mill, charged with 20 tons of 1.25″ iron balls and used for regrinding sand from a Dorr classifier, was lined with a $^5/_8$″ layer of rubber in Jan., 1923. After steady use it was still in first class condition in August, 1923. The cost of a $^5/_8$″ rubber lining is slightly less than that of a 2″ iron lining. Such a rubber lining is much easier to install or replace, has about $^1/_{20}$ the weight of the iron and will last at least as long and probably much longer. The rubber lining also gives much increased grinding capacity and somewhat less ball consumption. B. M. L.

A thermopile for measuring radiation. W. J. H. MOLL. *Proc. Phys. Soc. London*, **35**, 257–60(1923).—The thermopile is designed to be quick-reading, sensitive, and free from zero-errors. The cold junctions are in contact with metal masses which keep down their temp., and in order that the hot junctions may have small heat capacity the bimetallic strips composing the thermopile are made of plates of constantan and manganin, Ag-soldered along an edge, rolled in a direction parallel to the edge into thin foil, and then cut into strips perpendicular to the edge. C. C. V. V. (*C. A.*)

Electric furnace operation. ANON. *Elec. World*, **82**, 727(1923).—Discussion of costs, linings, suitable size, etc. by a number of elec. furnace experts. C. G. F. (*C. A.*)

Progress in the manufacture of steel in the electric furnace. CLAUSEL DE COUSSERGUES. *Rev. métal.*, **20**, 417–22(1923).—Discussion of the advantages of the elec. furnace with a description of the various types and their merits and disadvantages.

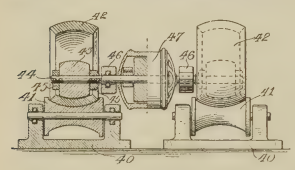
A. P.-C. (*C. A.*)

A new colorimeter with absolutely symmetrical rays. K. BÜRKER. *Z. angew. Chem.*, **36**, 427–9(1923); 3 cuts.—An immersion colorimeter, mounted on a stand like a microscope, the rays from the 2 tubes being thrown on the same field for comparison. Directions for operating are given. J. H. M. (*C. A.*)

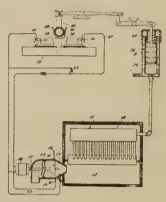
New liquid manometers and their use in heating and ventilating practice. E. NICKEL. *Feuerungstechnik*, **11**, 137–40(1923).—The form of draft gage described has a cylindrical well with axis horizontal, so that the gage can be used at different inclinations without affecting the zero reading. E. W. T. (*C. A.*)

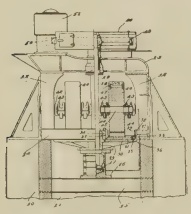
PATENTS

Roller-grinding machine. JOSÈ FERENCZ. U. S. 1,475,693, Nov. 27. A rolling mill comprising drums having open ends mounted for free rotation around a common horizontal axis, a grinding roller in each drum held by gravity in contact with the inner periphery of its respective drum, a shaft extending through said open ends and upon which said grinding rollers are rigidly secured, oscillatory guide arms for said shaft permitting radial displacement of the grinding rollers in relation to said axis, means for rotating said shaft with said grinding rollers; said rotating means including a motor suspended from said shaft, the weight of said motor, shaft, and grinding rollers being sustained upon the inner periphery of said drums; whereby a constant pressure is exerted against said drums independent of the revolving speed of the rollers.



Controller for fuel-oil burners. FINN S. HUDSON and EDGAR G. RHOADS. U. S. 1,475,433, Nov. 27. In a device of the class described, a steam-generating boiler having a fire-pot, a fuel-oil atomizer, an air-blower to deliver the fuel to the fire-pot, an elec. motor for the blower, an electric circuit for the motor having a switch, a cylinder having a piston and communicating with the boiler below the piston, a spring restraining the piston in its cylinder, an adjustable plate to vary the tension of the spring, a cap on the piston having an adjustable pin, and a lever coöperating with the pin and switch to open the latter when the piston is protracted and to close it when the piston is retracted.



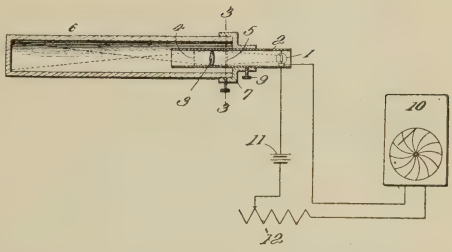


Dry pan. DAVIS BROWN. U. S. 1,476,143, Dec. 4. In an improved dry pan grinding mach., the combination of a vertically mounted rotatable pan, a rim on the periphery of said pan, a stationary rim located above and defining, with said first rim, an opening through which ground mat. may pass, and means for moving said rims relatively to each other to vary the width of said openings.

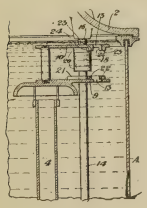
Electric resistance element. FRANK A. FAHRENWALD. U. S. 1,475,942, Dec. 4. An elec. resist. element made of an alloy of iron from about 16% to about 20% of chromium and about 1% to about 3% of manganese.

Apparatus for measuring high temperatures. JULIAN L. SCHUELER and CHESTER A. KELLOGG. U. S. 1,475,365, Nov. 27. In device for measg. high temps., in combination, a tubular body, a light sensitive cell in said bodv, a lens in said body, and means

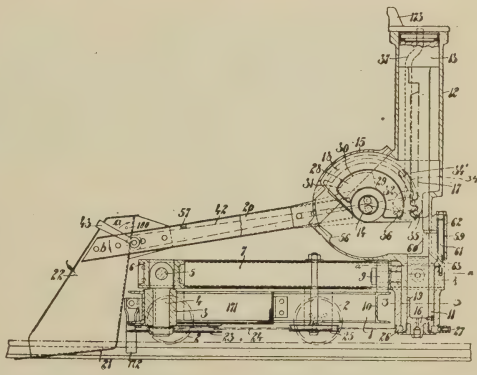
connected with said tubular body arranged to exclude light interfering media between said means and said cell and when subjected to ht. changing in degree of intensity of color which change affects the resist. of said cell.

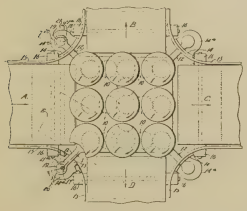


Liquid-measuring apparatus. GEORGE W. MACKENZIE. U. S. 1,475,844, Nov. 27. Locking mechanism for a liquid measg. app. of the class shown consisting of a vertically maintained rising and falling float, a vertically and annularly movable element having locking abutments for engagement by the top and bottom of the float, and means for locking the movable element at varying heights. In a liquid measg. app. having a vertically and rotatably movable supply and return conduit, a vertical guide rod, a freely movable float thereon, float-engaging plates connected with the conduit extending below and above the float in slotted engagement with the guide rod and having annularly arranged locking abutments for engagement by the float, and means for locking the conduit at varying heights.



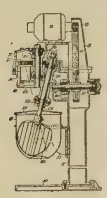
Loading machine for ores and the like. THORE ROBERT EUGEN RUNDQVIST. U. S. 1,475,888, Nov. 27. A mach. for loading ores and the like into cars on mine tracks, comprising in combination a carriage frame, wheels for supporting said frame, another frame, pivotally mounted on said carriage frame to sweep horizontally thereover, an upstanding power motor, pivotally mounted at the free end of said other frame to rotate around a vertical axis in relation thereto, a horizontal crank shaft of said motor, arms attached to said shaft, and a bucket carried by said arms. In a machine for loading ores and the like into cars on mine tracks, the combination with an upstanding cylinder, of a piston therein, means for introducing motive power on the upper side of said piston, a piston rod, a crank shaft, arms attached to said crank shaft, a bucket carried by said arms, and a connection between said piston rod and said crank shaft to cause the said bucket arms to swing upwardly upon the downward movement of the piston.



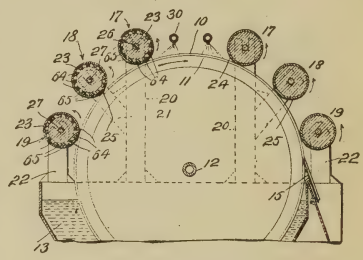


Transfer device for conveyers. SAMUEL OLSON. U. S. 1,475,962, Dec. 4. In combination with a plurality of conveyers arranged with adjacent termini, a transfer device comprising a group of driving members interposed between said termini and all mounted to rotate about axes slightly inclined from strictly vertical direction for exposing upwardly a limited portion of the circular driving surface of each member which extends in a plane substantially perpendicular to the axis of rotation of the member.

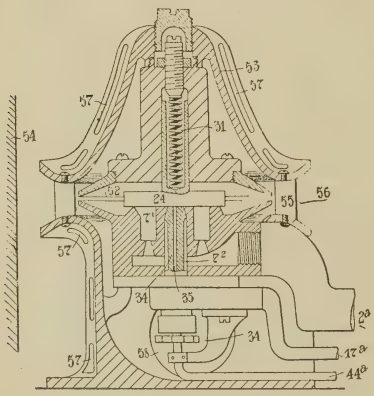
Beater. FREDERICK WESTERMAN. U. S. 1,475,978, Dec. 4. A beating app. comprising a receptacle having a cover provided with a central opening, a beater shaft set oblique to the vertical and entering the receptacle through the opening in the cover, a paddle on the shaft and in the receptacle, and means above and independent of the cover for supporting and rotating the shaft on its axis and also for bodily moving the shaft in a conical orbit having its apex substantially at the opening in the cover.



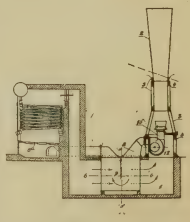
Filter. LOUIS C. ROLLS. U. S. 1,475,244, Nov. 27. A filter having, in combination, a continuously moving filtering surface, means for creating a vacuum at the filtering surface, means for covering the filtering surface with mat. to be filtered, means for supplying wash fluid to the surface of the mat., and a series of rolls mounted to rest upon the surface of the mat. and interposed in the path of travel of the fluid, all said rolls, except the last one, being provided with channels for the passageway of the fluid past the rolls.



Mechanical vaporizing oil burner. JAMES WALLACE TYGARD and ELIZABETH ANN TYGARD. U. S. 1,473,891, Nov. 13. In a mech. vaporizing oil burner for the production of mixtures of air and liquids, the combination of a hollow fixed member, a vibrating member located within the body of the fixed member in such manner as to divide it into substantially two compartments, whereby the movement of the vibrating member opens communication between said compartments when the vibrating member is actuated either by vacuum or pressure and automatically closes communication when pressure is released or vacuum broken, regulatable means for controlling the action of the vibrating member, means whereby a regulatable amount of gaseous or liquid fuel and air is admitted to one compartment, means whereby their incorporation into a finely pulverized homogeneous combustible or stable vaporous mixture is effected when passing from one compartment to the other, a suitable refrac. or protective enclosing envelope or cover having suitable passages for the introduction of cooling mediums and suitable annular openings through the side of said cover adapted to conduct the combustible vaporous mixtures generated in the carbureting device to the refractory wall or lining against which they burn when ignited.



Induced and forced draft apparatus. EMILE PRAT. U. S. 1,473,870, Nov. 13. An app. for the production of draft in fur. by simultaneous induction and blowing, comprising a chimney flue, a casing arranged within the chimney flue and divided into two compartments having independent central inlets and peripheral outlets, a rotatable shaft in said casing, bearings supporting said shaft at each end on opposite sides of the flue, fan sections carried by the shaft and operating in the respective compartments, a delivery nozzle on one of the sections



opening into the chimney at the axes thereof, said fan sections communicating with the interior of the chimney flue and being transversed by only a portion of the combustion gases from the fur. and adapted to produce a draft by ejector action in the chimney, the other fan section having its inlet in communication with the atmosphere and adapted to direct an air blast to the grate of the fur. See *Ceram. Abs.*, **2** [11], 263(1923).

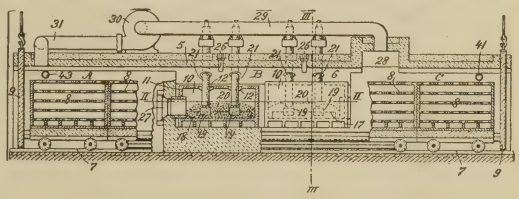
Kilns, Furnaces, Fuels and Combustion

Use of pulverized coal in open-hearth furnaces. R. H. LOWNDES. *Mech. Eng.*, **45** [11], 651–2(1923).—The cost of producing steel in open-hearth fur. burning pulverized coal at the Atlantic Steel Co. is greater than when natural gas is used. The life of the checker work is shortened by the use of pulverized coal. In a report on Pulverized Coal Systems in America, compiled by Leonard C. Harvey, and published in London in 1919, under the heading "Opinions of Users" occurs the following statement: "Have found the average life of checkers for various fuels in the open-hearth fur. to be: Natural gas, 1000 hts.; producer gas, 350 to 500 hts.; oil, 350 to 500 hts.; and pulverized coal, 225 to 250 hts. C. J. H.

Symposium on heat transfer. ERLE M. BILLINGS. *Science*, **58** [1508], 416 (1923).—A symposium on ht. transfer will be held at the spring meeting of the Amer. Chem. Soc. W. H. Adams, of the Mass. Inst. Tech., is chairman of this symposium. C. J. H.

PATENT

Tunnel kiln. GEORGE HILLARD BENJAMIN. U. S. 1,474,616, Nov. 20. A tunnel oven comprising a main chamber through which goods to be heated can be caused to travel; a htg. chamber on each side of the main chamber, structurally independent of the side walls and roof of the chamber; and means in each chamber for converting and transmitting elec. current into ht.



Geology

The superiority of British china clay. ANON. *Can. Min. Jour.*, **44**, 826–7(1923).—The world is still largely dependent on the unlimited supplies of china clays from Cornwall, England, which heads the list both in quantity and quality of production. Gradually increasing competition is noted from many foreign sources. Search for new deposits is active in Canada, U. S., and China. Canada has a good deposit near St. Remy D'Amherst, near Huberdeau, Quebec. It may ultimately supply all the needs of Eastern Canada. A deposit near Foochow, China, close to the South Manchuria Railway, is producing for export about 70,000 T. per annum. The U. S has relatively few deposits of good china clay so far discovered, which are chiefly in the S. states. B. M. L.

Notes on Canadian minerals—allanite, axinite, columbite, and sillimanite. T. L. WALKER AND A. L. PARSONS. *Univ. Toronto Studies, Geol. Surv.*, No. **16**, 29–37 (1923).—Allanite is described from pegmatites at (1) Seguin Falls, Ont., and (2) Labelle Co., Que. They differ considerably in composition. Analyses (E. W. Todd):

	SiO_2	ThO_2	CaO	FeO	MnO	MgO	Al_2O_3	Fe_2O_3	Ce_2O_3, etc.	Y_2O_3, etc.	H_2O	Sum
1	31.88	0.44	12.94	9.56	0.74	1.03	16.66	4.91	19.58	1.64	1.33	100.71
2	31.94	0.52	14.76	12.13	1.10	0.32	18.18	3.80	13.44	0.76	2.99	99.94

Sp. gr. (1) 3.658, (2) 3.279; *n* (1) 1.735, (2) 1.650; (1) birefringence 0.01, (2) isotropic. Axinite from Marmora Twp., Hastings Co., Ont. is found in a hornblende schist. Analysis (Todd): SiO_2 41.46, B_2O_3 4.88, Al_2O_3 19.94, Fe_2O_3 0.96, FeO 4.56, MnO 5.44, CaO 19.57, MgO 1.99, H_2O 1.61, sum 100.41, sp. gr. 3.221. The formula $13RO.B_2O_3.10SiO_2$ is suggested for axinite. Columbite. Four analyses (Todd) are given: (1) crystals, Lavers Mine, New Ross, N. S.; (2) Hazaribagh, Bengal; (3) Lyndoch Twp., Renfrew Co., Ont.; (4) massive with visible rutile, Hybla, Ont. All are from pegmatites.

	Cb_2O_5	Ta_2O_5	TiO_2	SiO_2	SnO_2	MnO	FeO	Sum	Sp. gr.
1	63.08	14.48	1.47	0.34	0.22	10.44	10.46	100.49	5.613
2	65.49	13.89	0.66	0.10	0.22	14.12	5.59	100.22[1]	5.563
3	55.79	15.21	5.19	1.28	0.56	10.24	10.90	100.14[2]	5.431
4	66.60	1.74	5.22	0.64	0.36	9.06	8.61	100.01[3]	5.147

[1] Also 0.15 CaO. [2] Also 0.15 CaO, 0.82 rare earths. [3] Also 1.25 ZrO_2, 3.44 ThO_2, 1.68 rare earths, 1.41 H_2O.

Sillimanite crystals, up to $^1/_2$ inch long, occur in a gneiss at Romaine, Que. The mineral is colorless and transparent. Analysis (Todd): SiO_2 36.70, Al_2O_2 62.73, Fe_2O_3 0.63, sum 100.06; sp. gr. 3.209. E. F. H. (*C. A.*)

Chemistry and Physics

The oxides of iron. J. D. Ferguson. *Jour. Wash. Acad. Sci.*, **13** [13], 275–81 (1923).—(1.) The iron phase in the system (H_2, H_2O, Fe, FeO) was studied in an elec. htd. tube fur. to det. the quantities of oxygen present. Materials used were electrolytic iron and piano wire. The temps. varied from 750°C to 980°C. Six runs were tabulated. Results indicated that the system does not contain appreciable quantities of O_2. (2.) The transition temp. of the ferrous oxide phase was studied and found to be somewhat below 577°C. The presence of ferro-ferric oxide in soln. in the ferrous oxide lowers this temp. (3.) Equilibrium constants at 750°C were checked by the stream method. Values were obtained indicating that the oxidation starts with a H_2O/H_2 ratio slightly less than .54. This work checked Chaudron's figures very well. F. C. F.

The thermal conductivity of materials employed in furnace construction. E. Griffiths. (Collected Researches.) *Natl. Phys. Lab.*, **15**, 1–15(1920); *Trans. Faraday Soc.*, **12** (1916).—Gives a critical summary of earlier determinations of conductivity of fire clay, silica and magnesite brick. In G.'s method the test brick of stand. size is htd. on one face by a bath of molten tin in expts. up to 450°, and above that temperature by pressing it against a flat iron plate forming a portion of the wall of a large uniformly heated muffle. Results by the 2 methods agree though the metal bath gives greater accuracy due to more uniform htg. Temps. are observed by means of thermocouples and ht. transfer by means of a flow calorimeter provided with a guard ring to protect the calorimeter against sharp temp. gradient. The following values were obtained for conductivity in C. G. S. units: Diatomaceous brick 105° to 502° mean temp., 0.000310 to 0.000461; matted slag wool, 194° to 476° mean temp., 0.000191 to 0.000342; magnesia pipe packing 310° mean temp., 0.00022. E. S.

Properties of powders. VI. Compressibility of powders. E. E. Walker. *Trans. Faraday Soc.*, **14**, 55-73(1923).—A method devised for measg. the resist. of powders to compression by static load and blows from a falling wt. Materials used were Pb, NH_4NO_3, NaCl, TNT, $CaCO_3$. Three classes of curves developed showing progress of compression varying with the type of mat. Microscopic examn. shows the extent of the deformation of the crystals. (More work could be done on this.) F. C. F.

Properties of powders. VII. Distribution of densities. E. E. WALKER. *Trans. Faraday Soc.*, **14**, 55–80(1923).—Local d. in columns of compressed powders studied. Various methods of packing compared. Some discussion of the effect of compression and d. on the cohesive power of the powder. F. C. F.

Simple method of determining apparent densities. KENNETH K. DODDS. *Chem. and Met. Eng.*, **29**, 324–5(1923).—Density is defined as the wt. (or mass) per unit volume, or wt. divided by vol. The vol. of continuous, impervious solids is readily found by the loss of wt. when suspended in water, since, by Archimedes' principle, the loss in wt. equals the wt. of an equal vol. of water. We have, then, $D = W_1/(W_1 - W_2)$, taking the d. of water as unity, where D = density, W_1 = wt. in air, W_2 = wt. suspended in water. Porous bodies cannot be so treated, owing to absorption of water, which causes the suspended wt. to be too great by an amount equal to weight of water thus absorbed. This objection could be overcome by weighing body after immersion. By subtracting the suspended wt. from the satd. wt., the absorbed water cancels out, leaving the bulk vol. Thus, $D = W_1/(W_3 - W_2)$, where W_3 = satd. wt. This suggests the method of measg. porosity by boiling in water, but the above process unfortunately is not applicable to the detn. of porosity. Numerical data is given showing apparent d. of coke, carbon, and various types of brick as detd. by the above method and by boiling under reduced pressure for 1 hr. The results agree to several units in the second decimal place. A. F. G.

Different types of plasticity of clays and kaolins. M. A. BIGOT. *Ceramique*, **26**, 194–8(1923).—B. divides the bonding power of kaolins and clays into 4 classes as follows: (1) Colloidal bonding power caused by extremely fine mineral particles; (2) lamellar bonding power caused by plates of kaolin, mica, etc., in clays; (3) organic bonding mats. as glue; and (4) fibrous bonding properties such as is caused by adding fibrous mat. to a plastic clay. The organic and fibrous bonding mats. make the clay more workable and cause it to be more resist. to breakage in the dry state. The lamellar bonding mats. cause the clay to be more workable in the plastic state and also impart strength to the dry clay. The colloidal bonding properties play an important rôle in ceramics. Those liquid, physical and chem. agents which develop the colloidal properties of clays are known as peptising agents. Those which destroy the colloidal properties are known as peptising agents. Clays and kaolins are more or less colloidal and are partly peptised by water. Plastic clay consists of 2 kinds of subs. One kind absorbs the water and swells and is peptised by the water. The other mat. is too coarse to become peptised and hence is simply coated with water, and does not swell. Petroleum when added to dry powdered clay and pressed into bricks at a high pressure does not develop strength in the clay upon drying but causes the clay to crumble to a powder. This is considered a pektising agent. On drying plastic clay it slowly shrinks and becomes hard. The plastic clay possesses colloidal properties and these colloids become pektised by driving the water from the colloid. The colloids thus pektised give strength to the clay. Plasticity, drying shrinkage, and strength are greatest for clays having the highest colloidal content. A thorough pektisation of the colloids of clay does not take place upon drying. A dry clay adsorbs moist. from the air, this being more from moist air than from dry air. Kaolins washed from disintegrated rocks of sand and mica do not have much bonding power. Clays removed from wet banks are on the other hand very plastic provided they are not too rich in sand and mica. All clays and kaolins contain organic matter and bacteria. Under the influence of time, wetness, and bacteria the colloidal portion of clays are increased. The Chinese allow their clays to remain in damp cellars for 100 yrs. before using them for pottery. By pressing and heating a pektisation of the colloid takes place. It was found that extremely plastic clays became insol. in water after heating to 400 °C. Lean clays and kaolins first became insol. in water after

heating to 500°C. Slaty clays first became insol. after heating to 600°C. Hot water produces less pektisation than press. and heat. Slaty clays are very difficult to pektise especially if they contain bituminum. If a bituminous slaty clay is pektised by heating to 600°C and then is treated with chemicals to remove the bituminous matter the clay becomes colloidal again and becomes pektised at 400°C instead of 600°C as was necessary for the bituminous clay. B. also detd. the effect of colloids in clay upon the resist. of the ware made from it to freezing. He used a brick clay containing considerable sand and mica as impurities. Three types of bodies were studied. (1) The powdered clay was heated to 150°C and pressed into bricks at this temp. with a press. of 700 kg./cm.^{2} (2) The powdered clay was dried at room temp. and mixed with 4% water and pressed at 700 kg./cm.^{2} (3) The clay was mixed to normal consistency with water and pressed into brick at 15 kg./cm.^{2} Separate samples of each of the 3 groups were fired at 900° and 1000°C. These bricks were saturated with water and frozen at −15°C for 4 hrs. This was repeated until the brick disintegrated. The results showed that bricks of groups 1 and 2 failed before the tenth treatment while those of group 3 withstood the tenth treatment. The brick of group 1 had practically no colloids but owing to the high pressure which it received it withstood the freezing test 4 hrs. The trial pieces of group 2 developed some colloids and this together with the press. caused it to withstand the freezing treatment for 8 hrs. In group 3 the max. amt. of colloids were developed and hence this brick withstood the freezing treatments longest. The brick of groups 1 and 2 had a very good appearance and were slightly less porous than those of group 3 but in spite of their lower porosity they failed in the freezing tests due to lack of pektised colloids. In making this clay into bricks and roofing tile it was found that a product most resist. to freezing could be made by making these from plastic clays. By using the dry press process about 6 hrs. can be saved in the time of manuf. but the product made in this manner is not resistant to freezing unless made from an exceptionally plastic clay. It is true that the bricks can be made more resist. to freezing by firing them to a higher temp. but by so doing the color is often spoiled and the fuel consumption increased. If a clay is dried in an atmos. satd. with H_2O a vapor press. is exerted in the clay which causes more colloids to become peptised and hence in drying develop greater strength. Ware dried in moist air becomes pektised at 400° to 450°C and after firing at 900°C is very resist. to frost. The drying in moist air requires 48 hrs. at 45°C and not quite 8 hrs. at 90°C. H. G. S.

The plasticity of crude gum. Marzetti. *Giorn. Chim. Ind. ed Appl.*, **5** [7], 342 (1923).—The plasticity is measured in an app. by which temp. and press. are regulated and the rate of flow through an aperture measured during time intervals. By this means the control of the heating of gum and an idea of the effect of heat on it is obtained. Drawing of apparatus is given. S. S. C.

Rapid technical determination of Fe_2O_3 and Al_2O_3 Luchessi. *Giorn. Chim. Ind. ed Appl.*, **5** [1], 12(1923).—The ppt. of hydrate of Al_2O_3 and Fe_2O_3 obtained with NH_4OH in presence of NH_4Cl is dissolved in $N/2$ H_2SO_4. The excess of acid is titrated with NaOH $N/2$ using methyl orange as an indicator. Difference of H_2SO_4 thus is left as combined with Al_2O_3 and Fe_2O_3. After addition of concd. H_2SO_4 and reducing with H_2S the Fe_2O_3 is gotten with $N/2$ $KMnO_4$. By calcn. the acid combined with Fe_2O_3 is obtained and Al_2O_3 is derived in like manner. S. S. C.

The ternary system of Al, Zn, Sn. Losana and Corozzi. *Gazz. chim. ital.*, **53** [8], 546(1923).—The binary system of Al–Sn, Al–Zn, Zn–Sn were investgd. and curves given showing eutectic points. Al–Sn is of simple type with a eutectic at 0.6% Al and 229°C. Sn–Zn system had eutectic at 197°C and 9.7% Sn with 0.5% α-Zn and up in solid soln. while at 49% Zn a conversion of Zn takes place. The Al–Zn system is complicated with solid solns. of the various forms of Al and Zn. The ternary system

has a eutectic at Al 1.46%, Zn 10.37%, Sn 88.17%, and 194°C. Diagram of system given and microphotographs of eutectic. S. S. C.

The ternary system of S, Se, Te. LOSANA. *Gazz. Chim. Ital.*, **53** [6], 396(1923).—Binary system of S–Se, Se–Te, S–Te were run. A eutectic of S–Se at 66% S and 104°C was found. Se–Te did not give a point and S–Te gave one at 109°C. 7% Te with a solid soln. present. No eutectic was formed in the ternary system. A diagram of system and microphotographs are given. S. S. C.

The ternary system of Al, Zn, Sn. E. CREPAZ. *Giorn. Chim. Ind. ed Appl.*, **5** [6], 285(1923).—A study of the ternary system of Al–Sn–Zn was made and a confirmation of the results obtained by other men. Eutectic of Al–Sn, Al–Zn, Zn–Sn systems were found. A eutectic of the ternary system found at 86Sn, 13Zn, 1Al and 210°C. Microphotographs of various points in the study are shown and tables of compns. of the system run are given with curves of binary and ternary systems. S. S. C.

The influence of some compounds on the transformation of quartz. PARRAVANO AND TURCO. *Gazz. Chim. Ital.*, **53** [4], 249(1923).—A rev. of work on increase of transformation of quartz by certain subs. is made. Expts. on ganister rock are made by the addition of various amts. of Fe_2O_3, P_2O_5, B_2O_3, CaO, WO_3 up to 1.5% and the samples burned to cone 15 and 18. The d. of all obtained and results are given showing in nearly all some effect. It was found that 3% of Fe_2O_3 did not greatly affect the refractoriness. B_2O_3 hastens the reaction. Microphotographs of the various mixts. and temp. show the amt. of conversion. Fe_2O_3 forms compd. with the SiO_2 and Al_2O_3. At cone 18 all the quartzite is converted to trydimite and cristobalite, with the trydimite being bonded by the cristobalite. S. S. C.

Effect of size and physical properties on the heat absorption of checkerbrick. O. A. HOUGEN AND DAVID H. EDWARDS. *Chem. and Met. Eng.*, **29**, 800–3(1923).—The transfer of ht. from the surface of the brick to its interior is computed by the aid of an equation taken from the mathematical theory of ht. conduction, connecting the heat flowing through 1 sq. cm. of surface in a given time, the thickness, thermal condy., sp. ht., apparent density, and temp. of surface. This applies to the case of parallel walls held at a constant temp. (Lord Kelvin's "infinite slab"), but, by means of Langmuir's shape factor, may be applied to the case of checkerbrick Curves are drawn showing rate of absorption of heat by silica brick of varying thickness ($2^1/_2$ in. to 10 in.), also by various refract. for a thickness of $2^1/_2$ in. Tables are computed showing time required by the different mats. to absorb 95% of the total heat, and the max. period of regenerative reversal. It appears that magnesia would make the most desirable checkerwork, were it not ruled out by its tendency to spall, as it absorbs 50% more heat than fire brick, and its reversing time (7 min.) is $^1/_3$ that of fire brick (21 min.). Carborundum ranks next, but when the reversal time is longer than 20 min., it offers no advantage over fire brick. Since the function of checkerwork is to store up a large amt. of ht. quickly, it is obvious that high thermal condy., d. and sp. ht. are all desirable qualifications, whereas materials of the insulating variety such as Sil-O-Cel should be avoided. A. F. G.

Some changes taking place in the low-temperature burning of Stourbridge fire clays. C. E. MOORE. *Trans. Ceram. Soc.*, **22** [2], 138(1922–23).—Three definite "critical ranges" are to be found in Stourbridge fire clay at temps. approximating to 700°C, 920°C, and 1030°C. The changes take place in all the clays of the series and at similar temps. in each. The magnitude of the changes and particularly of the 700°C and 900°C changes decreases with the alumina content. The examination of the changes in properties at these temps. gives results inexplicable by the kaolinite theory. The hexite-pentite theory provides a "clay substance" agreeing well with analytical results and with the geology of the deposits. The transformation of this "clay substance"

to an isomeric form gives a complete explanation of the changes in properties at 720°C and the critical ranges surrounding it. The polymerization of the isomer completely explains the 920°C change with the exception of the porosity results. The 1030°C change is probably of a purely mechanical nature and requires investigation. The hexite-pentite theory gives a more complete explanation of the processes involved than any other, and is to be regarded as the most successful theory of "clay substance" in its application to Stourbridge fire clay. H. F. S.

Measurement of the indices of refraction of a solid by immersion in a liquid heated to a determined temperature. P. GAUBERT. *Bull. soc. franc. mineral.*, **45,** 89–94 (1922).—The Becke or Schröder van der Kolk method for the petrographical microscope is used. The solid whose n is to be detd. is placed in a hot liquid of slightly lower n. As the liquid cools its n becomes greater and finally equals that of the solid. By noting the temp. at which this occurs an exact detn. of n may be made. There is a list of suitable media, with their n at room temp., and the value dn/dt from which n at any temp. up to the b. p. may be calcd. E. F. H. (*C. A.*)

Cohesion, hardness and toughness. P. LUDWIK. *Z. Metallkunde,* **14,** 101–10 (1922); *J. Inst. Metals,* **28,** 572. H. G. (*C. A.*)

The quantity and composition of colloid clay in kaolin from Meissen. ALBERT VASEL. *Kolloid.-Z.*, **33,** 178–80(1923).—The Meissner kaolin contained at least 3% of colloid clay whose compn. corresponded to the theoretical formula $Al_2O_3.2SiO_2.2H_2O$. Lime and magnesia did not enter into the compn. of the clay substance but were adsorbed by the colloid particles. H. M. McL. (*C. A.*)

The determination of chromium in the presence of organic matter. GEORGE GRASSER. *Z. Leder-Gerberei-Chem.*, **2,** 185–8(1923).—Several methods for the destruction of org. matter in chrome liquors were tried. It was found that oxidation with either $KClO_3$ or fusion with KNO_3 and subsequent titration with $Na_2S_2O_3$ gave good checks with the gravimetric detn. of Cr. Where $KMnO_4$ was used, variable results were obtained. E. J. K. (*C. A.*)

A new volumetric method for the determination of nickel. G. SPACU AND R. RIPAN. *Bul. soc. stiinte Cluj,* **1,** 325–31(1922); *Chem. Zentr.*, **1923,** II, 380.—The method is based on the complete pptn. of a sky-blue complex compd. of Ni from aq. soln. by K or NH_4 thiocyanate in the presence of C_5H_5N, thus: $NiX_2 + 4C_5H_5N + 2NH_4CNS \longrightarrow [Ni(C_5H_5N)_4](CNS)_2 + 2NH_4X$. An excess of 0.1 N NH_4CNS is added in the presence of C_5H_5N to the neutral or slightly acid Ni soln. and the NH_4CNS not reacting is titrated back with 0.1 N $AgNO_3$, $(NH_4)_2Fe(SO_4)_4$ being used as indicator. 2(CNS) corresponds to 1 Ni. Comparative expts. by electrolysis showed max. deviations of 0.11%. C. C. D. (*C. A.*)

The crystal structure of strontium selenide. MABEL K. SLATTERY. *Proc. Am. Phys. Soc.*, **1922;** *Phys. Rev.*, **20,** 84(1923).—SrSe has a simple cubic lattice with d = 3.10 Å. The unit cube has a side 3.10 Å, alternate corners being occupied by Sr and Se atoms. S. K. A. (*C. A.*)

Crystal structure of vanadium, germanium and graphite. A. W. HULL. *Proc. Am. Phys. Soc.*, **1922;** *Phys. Rev.*, **20,** 113(1922).—V has a body centered cubic lattice, side 3.04 Å; distance between nearest atoms, 2.63 Å; ideal d., 5.76. Ge has the same structure as the diamond. The side of the unit cube is 5.63 Å; distance between nearest atoms, 1.218 Å; d. 5.36. Graphite shows a lattice of the hexagonal close packed type, which is not in agreement with results of Debye. S. K. A. (*C. A.*)

Simplified determination of arsenic. POUSSIGUES. *Ann. chim. anal. chim. appl.*, **5,** 263–7(1923).—The method is similar in principal to that recommended by Copaux for the detn. of H_3PO_4. If a soln. of Na_2MoO_4 in dil. HNO_3 is mixed with pure ether and then treated with H_3AsO_4, 3 layers of liquid result. The bottom layer consists of

an oily, yellowish liquid contg. As and Mo; the middle layer is an aq. soln. contg. the excess of Na_2MoO_4 and the top layer consists of the excess ether. If the reaction takes place in a centrifuge tube graduated at the bottom, which is narrower than the rest of the tube, the quantity of As can be detd. by the depth of yellow liquid. It is necessary, however, to apply a correction for the soly. of the As compd. in the other 2 liquids. By this method of analysis good results are easily obtained in the analysis of tetrahedrite, pyrite and similar minerals contg. more than traces of As and no P. In the analysis it is recommended to use 25 cc. of soln. contg. 2.9 to 25 mg. of As, which should be added to a mixt. of 65 cc. Na_2MoO_4 soln. (100 g. MoO_3 suspended in hot water, neutralized with Na_2CO_3, poured into 700 cc. of 6 *N* HNO_3 and diluted to 1 l.) and 85 cc. of ether. W. T. H. (*C. A.*)

Volumetric method for the determination of magnesium. M. Bulli and L. Fernandes. *Ann. chim. applicata*, **12**, 44–5(1923).—The pptn. of $Mg(NH_4)_2Fe(CN)_6$ from solns. contg. Mg^{++} and $Fe(CN)_6^{----}$ in the presence of NH_4 salts is utilized for detg. Mg volumetrically. When cold, pptn. occurs only in concd. solns., but it is complete in hot dil. solns. with excess NH_4 salt and EtOH, though a direct volumetric detn. could not be developed because of the difficulty of reading the end point. Filtration and detn. of the excess $K_4Fe(CN)_6$ with $KMmO_4$ were not successful because of the difficulty of washing the ppt. and the formation of a ppt. of $Mn(NH_4)_2Fe(CN)_6$. *Procedure.* To the Mg soln. add an excess of $K_4Fe(CN)_6$ and of solid NH_4Cl, heat at 100° for 5–10 min., add approx. 0.05 vol. of EtOH and while hot titrate the excess $K_4Fe(CN)_6$ with 0.1 *N* $ZnSO_4$. The end point is reached when a drop of the supernatant liquid is not colored rose by a U salt. A drop of 0.1 *N* $ZnSO_4$ is sufficient in the titration to transform the rose color to a clear green and the point is sharper than that in the titration of Zn by the method of Galetti. Calc. the Mg from the reactions: $MgSO_4 + K_4Fe(CN)_6 + 2NH_4Cl \longrightarrow (NH_4)_2MgFe(CN)_6 + 2KCl + K_2SO_4$; $ZnSO_4 + K_4Fe(CN)_6 + 2NH_4Cl \longrightarrow (NH_4)_2ZnFe(CN)_6 + 2KCl + K_2SO_4$. C. C. D. (*C. A.*)

The practical application of flue gas analysis. C. F. Wade. *Fuel*, **2**, 202–3 (1923).—Of the 3 methods for detg. CO_2, (1) the intermittent "snap" test, (2) analysis of an av. sample over a period and (3) the continuous automatic record, the value of (2) is questioned, since no data are obtained on the cause of a low % CO_2 or as to whether conditions of firing are uniform or variable. (1) is useful in locating the cause of a low % CO_2 indicated by the automatic recorder, for by test holes at successive passes, an air leakage can be located. (3) should be used for detg. the efficiency of combustion, the presence of excess air and the % CO_2 per unit wt. of fuel consumed, rather than the % CO_2 in the waste gases. Flue gas anal., which has been neglected in regenerative processes, reveals serious losses and great variations in the compn. of chimney gases. C. C. D. (*C. A.*)

PATENT

Process for refining tin and antimony. Georges Bonnard. U. S. 1,475,422, Nov. 27. The herein described process of refining tin and antimony which comprises subjecting crude tin to the action of dry chlorine, separating the liquid chlorides thus obtained from the solid and semi-solid materials, adding water to said liquid mixtures to produce a solution of stannic chloride and decompose the chlorides of antimony, arsenic and sulphur, separating out the solution of stannic chloride, and electrolytically obtaining tin from such solution.

General

Technical education in relation to the refractories industry. G. W. Hefford. *Trans. Ceram. Soc.*, **22** [2], 205(1922–23).—There are undoubtedly numbers of first-

rate men in the industry, so far as their experience goes really first-rate, but for lack of suitable scien. training they are unable to translate the results of research into works practice. The function of research work in connection with industry is something more than the provision of foolproof tips; it is to det. principles and constants, which, by men with training, acumen and imagination can be applied in the circumstances of the particular works in which they are interested. An interesting attempt has just been started at Brierley Hill to provide suitable instruction in refracs.; its success will be detd. largely by the amt. of practical support it receives from the indus., and the amt. of practical sympathy the industry extends to the students. H. F. S.

Prepared non-metallics in Canada. S. J. Cook. *Can. Chem. & Met.*, **7** [9], 226–31(1923).—Includes figures of consumption of many ceram. mats. in Canada during 1922, also a few notes on the production of ceram. products. B. M. L.

Dressing crude chalk by modern methods. A. B. Parsons. *Eng. & Min. Jour. Press*, **116** [10], 415–20(1923).—In its whiting dept., the Benjamin Moore Co., at Carteret, N. J., has cut its costs nearly 50% by re-equipping an old plant with modern mach. Crude French chalk is dressed to remove 8% sand and 20% moisture and the product ground to −300 mesh. A flow sheet and pictures and drawings of mach. in the new plant are given in the article. A grab bucket crane for large unloading, modern conveyor mach., Dorr classifiers and a vacuum filter have reduced the labor force from 38 to 9 workmen of the same ability. Much of this equipment is applicable to the dressing of feldspar, kaolin, silica, etc. B. M. L.

Melting in electric furnace. J. L. Cawthon, Jr. *Foundry*, **51** [23], 938(1923).—A description of current practice in the production of synthetic cast iron in both acid and basic elec. fur. Typical charges, when melted down contain about 2.50% C. To secure a carbon content over 2.75% it is necessary to have a clean bath of superheated metal, agitated vigorously. The silicon content is adjusted by the addn. of 50% ferro-silicon, and manganese is added as ferro-manganese. A rapid method of testing the metal before pouring is given, together with a chart for calcg. mixts. M. E. M.

Describes cupola reactions. J. Coll. *Foundry*, **51** [23], 961(1923).—A review of present day theories concerning reactions within a cupola, with some conclusions by the author. M. E. M.

The dusted lung with special reference to the inhalation of silica dust and its relation to pulmonary tuberculosis. B. S. Nicholson. *J. Ind. Hyg.*, **5**, 220–42(1923). E. J. C. (*C. A.*)

The partial decomposition of certain solid substances effected by grinding. John Johnston. *Rec. trav. chim.*, **42**, 850–4(1923).—The process of grinding a solid may be accompanied by certain changes in the compn. of the mat. In particular it may cause a solid substance, which on dissociating yields a gaseous product, to lose some part of this volatile component. From theoretical considerations it appears that this partial loss of volatile component may occur more generally than has hitherto been supposed; and expt. has confirmed this deduction. In many cases the loss will be unappreciable because the dissoc. pressure is too small or the rate of dissoc. too small, or because the substance is not hard and crushes easily. In other cases like the hydrates the loss may be so large as seriously to affect analytical results. E. J. W. (*C. A.*)

Producer gas and gas-producer practice. III. R. V. Wheeler. *Fuel*, **2**, 182–6, 219–21(1923); cf. *C. A.*, **17**, 203, 3088.—Producer construction, grates, solid-bottom, bar-bottom and H_2O-bottom producers, the body of the producer, the charging hopper, the method of providing the blast and the use of superheated blasts are described with diagrams. C. C. D. (*C. A.*)

CERAMIC ABSTRACTS

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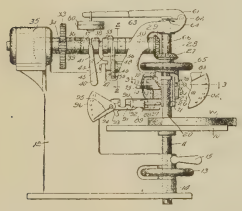
Abrasives

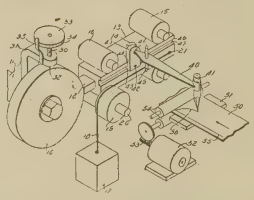
Abrasives. Anon. *Mineral Ind.*, **31**, 1–7(1922).—A review of the abrasives industry. A. B. (*C. A.*)

PATENTS

Method of and apparatus for grading. Charles J. Hudson and Wilson C. Broga. U. S. 1,478,335, Dec. 18.—The method of grading an article of bonded abrasive grains which comprises relatively moving a wearable tool and said article in contact through an extensive circular path and thereby abrading the tool by the action of successive abrasive grains, simultaneously feeding the tool forward under a definite press., continuing said relative movement for a definite period and until a measurable reduction in tool size has been produced, and measg. the combined amts. of wear upon the article and the tool produced by such abrasion.



Process and apparatus for classifying grinding wheels. Charles E. Gillett. U. S. 1,478,333, Dec. 18. The method of classifying a grinding wheel comprising the steps of rotating the wheel at a normal grinding velocity, grinding a standard wearable tool thereby under uniform press. and for a definite period, making successive determinations of the grinding effect of the wheel on the tool as the opern. proceeds, measg. the wheel wear produced in the time interval, and from the grinding characteristics thus observed classifying the wheel by comparison with data obtained with standard wheels



Art

Color measurement by the Ostwald method. Ismar Ginsberg. *Textile World*, **64**, 1519–21, 1539(1923); cf. *C. A.*, **17**, 2384.—The practical application of the Ostwald theory to color analysis and the detn. of color purity are discussed. The convenience of the method in designating colors and defining fastness is pointed out. A description of the app. is given. C. E. M. (*C. A.*)

Cement, Lime and Plaster

Continuous automatic shaft kiln for cement plants. F. deM. Tubman. *Rock Products*, **26** [25], 20(1923).—Successful European practice is described, largely the Buhler system. Fuel, coke breeze or anthracite of pea size, and raw mat. are weighed, mixed, moistened with the detd. amt. of water, and briquetted. The briquettes push each other over a bridge to a movable feeding and distributing device. The kilns range to 9 ft. internal diam. with walls of ordinary mat. to 26 ft. in height. Forced draft of approx. 200 mm. water is used, and an output of 45 tons per 24 hrs. with the 9 ft. kiln is obtained. Discharge is secured at the bottom of the shaft by means of a

ribbed cone, toothed rolls, or preferably by a Buhler toothed rasp or ram moving horizontally, and actuated hydraulically giving an even discharge. The clinker is then removed through air locks, and conveyed to storage. Fuel econ., low power consumption in opern., less and easier repairing of kiln, flexibility of opern., ability to stop kiln for any period to 24 hrs., space econ., better and quicker pulverizing of clinker, and excellent quality cement requiring low gypsum content are advantages claimed for product over that of rotary kiln. C. R.

Lime-kiln thermal efficiency. V. J. Azbe. *Rock Products*, **26** [16], 35(1923).—The percentages of CO_2, O_2, and CO in the waste gases, together with the temperature of the gas, and a knowledge of the fuel used are made the basis for the calcns. The tons of lime per ton of coal, and the thermal efficiency of the kiln are calcd. in the usual manner. The greatest ht. loss is due to escape of waste gases at a high temp. either incompletely burned, or with a large amt. of excess air, and can be more readily controlled than losses due to radiation, ht. in burned lime, moisture, etc. Excess O_2 over 2% means that the excess air carries off sensible ht., overloads the gas carrying capacity of the kiln, reduces the kiln temp. and ht. transfer, and reduces the output. In opern. of lime kiln a better proportioning of air and fuel, more regularity, more uniformly sized rock, and better charging are needed. Graphs are furnished for tons of lime per ton of coal, thermal efficiency, fuel loss due to escape of waste products (dry), withdrawal of hot lime, and incomplete combustion, and loss of lime due to too great amt. of excess air. C. R.

The spontaneous disintegration of cement clinker on cooling in the air. J. Dautrebande. *Le Ciment*, **28**, 355–60(1923).—It is maintained that the disintegrating of cement clinker in air is due to the formation of bicalcium silicate ($2CaO.SiO_2$), and that this compd. may be formed not only as the result of an excess of silica for the formation of tricalcium silicate $(3CaO.SiO)_2$, but also from insufficient burning, and from overburning of the charge. The causes for disintegration may be subdivided as follows: (A) **Clinker partially reduced to powder.**—(1) Silica content of the fine powder much higher than that in the lump clinker. (Analyses I.) This may result (*a*) from segrega-

	I		III	II	
	Lump clinker	Powder		Lump clinker	Powder
SiO_2	25.10%	29.16%	28.38%	22.45%	24.00%
Al_2O_3 / Fe_2O_3	12.20	13.70	16.55	9.25	9.75
CaO	61.10	56.20	54.74	65.00	63.00
MgO	0.20	0.18	..	1.70	1.44
SO_3	0.24	0.21	0.27	0.51	2.12
Ign. loss	0.45	0.38	0.28	0.60	0.80
	99.29	99.83	100.22	99.51	99.11

tion of the silica due to poor mixing, (*b*) from an excess of silica in the batch due to poor propng. of the raw mats., (*c*) from an increase in the silica content of the clinker due to the incorporation of high silica ash from the fuel, and (*d*) in rare cases from inclusion of silica from the lining of the fur. (2) Excess of silica in powder over silica in the lump clinker, not sufficient to cause disintegration. (Analyses II.) Due to insufficient burning some bicalcium silicate is formed. (B) **Clinker totally reduced to powder.**—(1). Silica content of the batch too high, with the resulting formation of bicalcium silicate. (Analysis III.) (2) The compn. of the cement does not differ from other

known stable cements. The cause in this case was too much free sand in the batch, and insufficient burning to obtain tricalcium silicate. A sufficient quantity of Fe_2O_3 is often necessary to help the fusion. **Tests on Disintegrated clinker.**—If instead of allowing the clinker to cool in the air where it would disintegrate, it is thrown into cold water, the clinker remains intact. On drying and grinding the clinker, a cement is produced which when tempered with water has hydraulic properties. This would seem to indicate that there are two allotropic forms of the bicalcium silicate. The powder of bicalcium silicate resulting from the overburning of clinker has a grey-blue color, and a sp. gr. of 3.14 to 3.18. On adding the powder to cements and mortars, the increase in powder content from 10 to 50% (*a*) required increasing amts. of water for tempering the mixts., (*b*) delayed the time of initial and final set, and (*c*) decreased the crushing strength appreciably at each addition of powder. Cf. *Jour. Amer. Ceram. Soc.*, **4** [10], 874(1921). L. N.

White brick made from blast furnace slag. AUGUSTE LIEVIN. *Rev. Mat. Constr. Trav. Pub.*, **170**, 241–3(1923).—Slag from blast furnaces is run into water, where it breaks up into granular pieces. 30% of lime is added to the dried slag and the mixture pulverized in a tube ball mill. The resulting mass is then mixed with 10% lime and sufficient water to moisten it. The body is pressed into brick in a brick machine, with a capacity of 1000 brick per hour. After hardening for three months, the brick are ready for use. Six photographs are given of the plant at Pont-à-Mousson (France), where the slag is utilized for brick-making. L. N.

The setting of plaster. JOLIBOIS AND CHASSEVANT. *Comptes Rendus*, **177** [2], 113–116(1923).—At a temp. of 30° $CaSO_4$ calcined at 300° and below gives a supersatd. soln. of 7.3 g. per l. of anhyd. $CaSO_4$. The dihydrated $CaSO_4$ gives a satd. soln. of 2.1 g. per l. at 30°. The soln. reaches its limit of supersatn. in approx. 10 min. When calcined above 300° the max. soly. of $CaSO_4$ becomes a function of the temp. at which it was calcined. The setting of anhyd. $CaSO_4$ proceeds in 3 steps. (1) Formation of solid hemihydrate $CaSO_4{}^1/_2H_2O$. (2) Soln. of $CaSO_4{}^1/_2H_2O$. (3) Crystn. of gypsum. Cf. *Ceram. Abs.*, **2** [10], 214(1923). W. R. K.

Potash and waste heat recovery from cement kilns. ANON. *Chem. Age*, **9**, 442(1923).—Announcement has been made of a new method of effecting recovery of potash from dust of cement kilns (an English invention), which new process presents possibilities in the way of utilizing waste heat for steam-raising purposes. Expts. with this system have shown that with certain grades of raw mat. some of the dust from the kilns will collect in caked form on hot surfaces, and that this caked mat. contains potash salts and other ingredients which make it valuable; this caking mat. may be sold at a much higher price than the finished cement. The part of the dust adhering or caking to the hot surfaces has a different chem. compn. from the rest of the dust which will not so adhere, making possible the recovery of the valuable by-product. This caked mat. is removed from the walls by means of scrapers; from the primary collecting flue hot gases are led through a ht. absorbing device in the shape of a waste-ht. boiler. Here a considerable reduction in temp. of the gases is effected; their vol. and velocity are likewise reduced and separation of the remainder of the dust is facilitated. The inventor states that because of the cooling of the gases in this way the dry dust separators beyond the boiler have gases of less velocity to handle; moreover the washers through which the gases subsequently pass, operate much more satisfactorily on the cooled gases, as very hot gases tend to evap. and carry away the spray water in the form of steam, and interfere with the satisfactory opern. of the washer generally. Also the cooled gases are much more readily handled by the fan. In cases where the final removal of the dust is effected by elec. means, the reduction in temp. of the gases is of great advantage. O. P. R. O.

Dehydrating gypsum by steam under pressure. F. B. STUART AND C. A. RIVERO. *Chem. Age* (N. Y.), **31,** 476(1923).—The common practice has been to break up the rock gypsum and then ht. the fragments by means of an open fire to drive out the moist. This has been both wasteful and expensive. F. B. Stuart and C. A. Rivers of El Paso, Texas, have demonstrated that gypsum can be dehydrated by steam as shown in U. S. Pat. No. 1,463,913. By this method the rock gypsum is loaded into steel cars which are run into cylinders of 6 ft. diam. After bolting on the cylinder heads, steam is admitted to 150 lbs. pressure, where it is maintained for about 4 hrs., depending largely on the physical structure of the gypsum. At the expiration of this period the steam is shut off and after the pressure within the cylinder has been considerably reduced, the balance of the steam is blown off. Upon the removal of the car from the cylinder it will be found that the gypsum has been uniformly dehydrated. It is now ready to be crushed and pulverized. The material in this form is commercially known as plaster of Paris and is mixed with other substances in the manuf. of numerous forms of building material in which gypsum is a primary constituent. O. P. R. O.

A study of lime kilns. A. E. TRUESDELL. *Rock Products,* **26,** 9–15(1923); cf. *Ceram. Abs.,* **1** [9], 242(1922).—In a progressive series of articles, kilns, principles of combustion, dissociation of limestone, htg. chambers and fur., efficiency and econ. of kilns, control of kilns are discussed, and a general summary is made at end. In proper combustion amt. of excess air, draft, ht. losses, and manner of htg. must be considered. Cryst. stones which disintegrate under slight shocks while htg. must be burned in some manner which disturbs the stone less *e. g.,* in a pot kiln, or where motion can be controlled as in rotary kiln. Since lime is a poorer ht. conductor than stone, the smaller the lumps the less ht. required to dissociate entire lump, and the quicker it will take place. Approx. 1250°C is used for burning high Ca lime. The introduction of steam by various means assists the dissociation. The size and shape of htg. chamber should comform to best practice for the particular stone. Vertical kilns cannot burn soft or small stone. Hoffman or ring kilns will burn soft stone. Rotary kilns due to control burn various types including soft and small sized mat. All fuels are used, but a high calorific value fuel is not needed since temp. is not high. Radiation, poor combustion, excess air, too much draft, improper design of fur., lack of attention to charac. of different fuels are causes of ht. losses and trouble. The fixed charges for opern. of a lime plant must also be considered before deciding on equipment to be used as this has an appreciable effect on cost of burned product. Advantages and disadvantages of pot kiln, mixed feed kiln, vertical kiln, Hoffman or ring kiln, tunnel and rotary kiln are listed and briefly discussed. In any case local conditions as regards stone, fuel, power supply and market will also govern selection of kiln. C. R.

Plaster from limestone dust. C. F. WILLARD. *Rock Products,* **26,** No. 13, 39–42 (1923).—By reducing limestone to a colloidal state it is possible to make a hard plaster and thus eliminate the cycle of limeburning, hydrating and hardening. Incorporated solid colors are unaffected and plaster is waterproof. Walls thus finished can be polished with an agate burnisher and a surface like marble produced. It adheres to rough boards and can be used as a stucco material. Patents are applied for. H. C. P. (*C. A.*)

The influence of temperature on the disintegration of Portland cements due to the presence of gypsum. H. KÜHL AND H. ALBERT. *Zement,* **12,** 201–3, 210–13(1923).—Port. cements were mixed with 2, 10 and 20% gypsum. Test specimens were made of each. These were stored at temps. varying from 0° to 100°. The specimens with 2% gypsum showed some disintegration at the end of 28 days. Those with 10% gypsum disintegrated at the end of 14 days and those with 20% gypsum at the end of 7 days. The greatest disintegration occurred at 20–40°. At 100°, no disintegration occurred in any of the specimens. R. F. S. (*C. A.*)

Enamel

Records early stove industry. E. C. KREUTZBERG. *Foundry*, **51** [24], 973–80 (1923).—An historical acct. of stove manuf. in the U. S. in colonial days, with many photographs. M. E. M.

Tells of pearlitic cast iron. CARL SIPP. *Foundry*, **51** [24], 986–7(1923).—Pearlitic cast iron is a recent development in Germany. The author claims a high degree of flexibility, increased resist. to shock, high combined carbon without a high brinnell hardness, and great stability of structure at high temp. No details are given of the process of manuf., which is patented. M. E. M.

Glass

Natural sillimanite as a glass refractory material. S. ENGLISH. *Jour. Soc. Glass Tech.*, **7** [27], 248(1923).—An investigation as to the suitability of natural sillimanite as a glass making refrac. The foll. tests were carried out: Detn. of a suitable working mixture; meas. of the drying and firing contractions; detn. of the porosity after firing; meas. of the amt. of the corrosion by soda-lime and potash lead-oxide glasses; meas. of the reversible thermal expansion. For purposes of comparison similar meas. under identical conditions were made on a standard pot clay mixt. Natural sillimanite can be satisfactorily bonded so as to form slabs and small crucibles by the use of a comparatively small portion (9%) of ball clay. On drying this mixt. of sillimanite and clay shows a very small shrinkage and on burning to 1400° it has a negligibly small further contraction. The porosity of the fired sillimanite mixt. is rather less than that of a standard pot clay mixt. Sillimanite crucibles suffer very much less than do clay crucibles from the attack of glass at high temps. Up to 800° the coeff. of expansion of the sillimanite mixt. after burning at 1400° is quite regular and has a value very close to the mean coeff. of expansion of a hard burned standard clay mixt. Natural sillimanite should serve as an excellent basis for glass-making refrac., chiefly on account of its high m. p., its very low drying and firing shrinkages and its marked resistance to corrosion by molten glass. J. G. P.

The corrosion of fire clay by alkali-lead oxide glasses. EDITH M. FIRTH, DONALD TURNER AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **7** [27], 218(1923).—Expts. were made in small exptl. pots on the corrosive action of soda and potash-lead oxide batches on different fire clays at a temp. of 1350°, the amt. of corrosion being measd. by the amt. of alumina and iron oxide abstracted from the fire clay during the melting process. The results showed that: Different fire clays resist the action of melted batch to different extents. High alumina content alone does not bestow resistance to corrosion on a fire clay nor alone does low porosity. Of 4 clays tested the least corroded and the most corroded both had a high alumina content and low porosity. Potash glasses are not less corrosive than soda glasses of equivalent alkali content. In our expts. they were found to be somewhat more corrosive. The corrosion of fire clay refrac. mats. occurs most actively during the melting opern. the attack by the glass itself being very much slower than that due to the batch constituents, especially the alkali salts. It was proved that maintaining a pot at a temp. of 1350° for a period prior to charging in batch increased its resistance materially to attack. Firing for 24 hrs. gave much better results than 3 hrs. Spraying the interior of the pot with a little soda ash and htg. it for 3 hrs. at 1350° was not found to possess any advantage in diminishing corrosion. Thorough batch mixing and rapid melting should conduce to diminish the corrosion of fire clay glass batches. J. G. P.

Some observations on the corrosion of fire clay materials by alkali salts. DONALD TURNER AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **7** [27], 207(1923).—Mixts.

of well burnt fire clay grog with a particular alkali salt were htd. together in a crucible of non-corrodible mat., and detns. of the corrosive action were made. Methods given. Sodium carbonate, potassium carbonate, sodium nitrate, potassium nitrate and borax all attack well-burnt fire clay extensively even at as low a temp. as 800°. The nitrates are more corrosive than the carbonates, and the potassium salts more active than the sodium salts. Sodium sulphate at 800° has only a very slight action on burnt clay as compared with the carbonate and nitrate. Rise of temp. between 800° and 900° causes a rapid increase in the rate of corrosion due to carbonates and nitrates. Different clays, fired at the same temp., exercise different degrees of resistance to corrosion by alkali salts. The resistance is not dependent directly on the chem. compn. One aluminous clay was most attacked while a second was least attacked of 4 clays tested. The corrosion probably depends on the density of the clay body. Fire clay burnt at 1400° is more resistant to corrosion than when burnt only at 1300°. J. G. P.

The effect of saltcake in soda-lime batches in corroding fire clay refractory materials. EDITH M. FIRTH, F. W. HODKIN AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **7** [27], (1923).—A series of glass batches was prepd. in which the soda ash was gradually replaced by its equivalent of salt cake and from them glasses were melted. Meltings were made in small crucibles and were made in triplicate, the 3 pots being set in the same fur. so as to insure, as far as possible, similarity of fur. conditions. Melts were made to definite temps. and for definite time intervals and an analysis of each sample of glass was made to det. from the increase in the amt. of alumina and iron oxide the extensiveness of corrosion. Results are given and a discussion. J. G. P.

Ionization in glass. Ionization by collision in glass at high field strength. A. GUNTHER-SCHULZE. *Physik. Z.*, **24**, 212–3(1923).—The sp. condy. of glass at high elec. field strength can be compared to the same phenomenon in gases. Log α = abX, α being the measd. condy. and X, the field strength. W. M. C.

Notes on the Ashley bottle machine. S. ENGLISH. *Pottery Gaz.*, **48**, 1299(1923).—History of development of Ashley bottle machine. J. W. H.

The effect of titania on the properties of glasses. W. E. S. TURNER AND A. R. SHEEN. *Pottery Gaz.*, **48**, 1804–8(1923).—Titania renders annealing of glasses easier and hinders the devitrification. If titania glasses are ht.-resisting as all available literature indicates, this property is not due to a low thermal expansion, hence further tests are necessary to det. accurately why titania glasses are ht. resisting. J. W. H.

Italian laboratory glass industry. ANON. *Chem. Trade Jour. & Chem. Eng.*, **73**, 459(1923).—The war is responsible for the lab. glass indus. in Italy, which has grown to such propns. that it now supplies the home market completely and also exports neutral glass tubes to Spain, France and Belgium. The quality of the products has secured a reputation even in competition with the world famous products of Jena. O. P. R. O.

Automatic manufacture of glass bottles. ALEXANDER FERGUSON. *Chem. Trade Jour. & Chem. Eng.*, **73**, 393(1923).—F. gives a description of the new automatic mach. for mass production of glass bottles, for which he has prepd. designs. It is called the cyclone fur., and it is said that it allows 540 T. of glass to be made in 168 hrs. per week, or 120 bottles per min. Ordinary tanks usually require 100 T. of coal to 100 T. of glass, while it is possible, with the cyclone fur., to use only 30% coal to glass, with a safety margin of $13^1/_2$ T. in each 100 T. glass in a fur. occupying 600 sq. ft. instead of the present 8800 sq. ft., and yet leaving the ground area clear for any other purpose. It is claimed to be also entirely automatic, requiring no skilled labor after the chemist has settled the batches for the glass required. The principal feature of the fur. is that the burners are so set as to give a whirling motion to the gases, which travel about 175 ft. per sec. The walls of the fur. are inclined from top to bottom and the batch mat. is ground to a mesh of about 60. Into these whirling gases the batch mat. is fed, and the description

of the opern. is that the molecules of glass, once formed, are cast forth from the whirling gases and coalesce into a liquid homogeneous paste and flow down the walls of the fur. like glucose under the influence of radiant heat. The glass passes on to the forehearth, from which it is gathered and delivered to the bottle-forming plant. The next portion of the app. is that in which the molten glass is sucked up automatically and transferred to the molds, which are mounted on the periphery of a large wheel. These rotating gatherers are so arranged as to suck up the desired quantity for the particular size bottle. The cyclone machines occupy only $^1/_8$ the area of the Owen's gatherer with 3 times the capacity, although the times in the molds are identical. The total outlay on the machine and on operation is much less than in ordinary practice. So far it is just in the exptl. stage, but the demonstration given has been satisfactory. O. P. R. O.

Glass manufacture. ANON. *S. African Jour. Indus.*, **6,** 146(1923).—Glass manuf. on larger scale is needed for the Union of S. A. At the present time the Union is importing glass bottles and jars at the rate of some £115,000 per annum. Inquiries into the raw mats. have, so far, left no doubt that everything requisite for the making of, at least, common glass suitable for bottles and jars for commercial purposes is obtainable in S. A., and it is believed by competent judges that the whole of this oversea expenditure could be avoided by local glass manuf., and further that a surplus could be provided for an export trade. O. P. R. O.

The geology of glass sands. H. E. ELKINGTON. *Rock Products*, **26** [19], 28 (1923).—The origin of the 4 large glass sand producing regions of the U. S. are discussed briefly. N. J. sand is a refuse sand, with rounded grains, and usually contaminated with ilmanite, rutile, brookite. Pa. sand of the Oriskany region has been consolidated on deposition by ht. and press. and a sandstone of great firmness has been formed. The grains are sharp, and free from the contaminating subs. of the Jersey sands. Ill. glass sand is rounded, and of great purity, being laid down in St. Peter's period of the Ordovician age, and then sorted afterwards by wind and water. The Mo. deposits are similar to the Ill. deposits though smaller. C. R.

Initial heat leers. W. S. MAYERS. *Glass Ind.*, **4,** 163–6(1923).—In the initial heat leer the ware is introduced immediately after being pressed while still luminously hot, and becomes uniformly heated by internal conduction. Very little outside ht. is necessary as only the pans of the leer need be heated. The ware passes through a tunnel heavily insulated against heat loss, and cools gradually as usual. These leers require only about $^1/_5$ the pan area required by an ordinary leer of the same production. See *Ceram. Abs.*, **2** [5], 96(1923). D. E. S.

Electrification of the Allegheny Plate Glass Company. G. P. WILSON. *Glass Ind.*, **4,** 127–9, 152–3, 169–72(1923); (Reprinted from *Elec. Jour.*, **20,** April(1923)).—This article is a description of the process of making plate glass at Glassmere, and is illusd. with cuts of elec. controls, layout diagrams, etc. The whole plant is operated by elec. power. D. E. S.

Furnace and combustion calculations. H. S. BRADY. *Glass Ind.*, **4,** 148–52 (1923).—Calculations are given of draft pressure, ht. regeneration, theoretical flame temp. and air required for complete combustion. D. E. S.

Tensile strength of glass. J. T. LITTLETON. *Phys. Rev.* (1923).—Lack of uniformity and reliability in the results hitherto obtained is due to the fact that the strength of the surface is greatly reduced by slight scratches. *The new method of measurement* here described, attempts to eliminate as far as possible the effect of surface defects. A bar of glass is used which has been cut from the middle of a slab which had been heat treated in such a way as to leave the upper and lower surfaces of the bar under high compression, while the inside is under tension. When this bar is broken by bending, the tension introduced in the lower surface is largely neutralized by the initial compres-

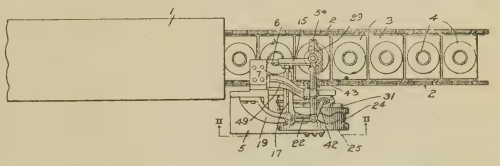
sion, so that the maximum tension is not in the lower surface but in a zone nearer the neutral axis. The initial stresses are measured by means of polarized sodium light and a calibrated Babinet compensator, and these combined graphically with the stress due to the central load required to break the bar, give the maximum tension introduced which is taken as the lower limit to the strength of the glass. In this way values of 12 and 15 kg./mm.^{2} were obtained for a lead glass and a borosilicate glass, values twice as great as those given by the usual methods; and the mean deviation of individual measurements is less than half as great. J. T. L., Jr.

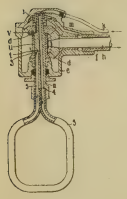
The wetting of glasses by mercury. Earle E. Schumacher. *Jour. Amer. Chem. Soc.*, **45**, 2255–61(1923).—Hg was placed in containers whose walls were as free as possible from adsorbed gas. Wetting was generally obtained on containers of quartz but only occasionally on pyrex or soda-lime glass. The difficulty of removing adsorbed gas increases with the alk. content of the glass and the tendency toward wetting with Hg decreases. This latter may be due to the adsorbed gas or to formation of a surface film of NaOH and amorph. SiO_2. D. E. S.

Polishing glass with acid. O. Parkert. *Diamant*, **45**, 165, 177(1923); cf. *Ceram. Abs.*, **2** [6], 166(1923).—The ware is first washed in a bath of H_2O 1000, H_2SO_4 12, and HCl 1. It is then dipped for about 45 sec. in a soln. of H_2O 1, H_2SO_4 2, and HF 1, preferably kept at a temp. of 40–50°. J. B. P. (*C. A.*)

PATENTS

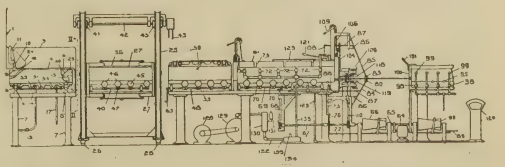
Glassworking machine. Theodore H. Sloan. U. S. 1,478,261, Dec. 18. In a glass-finishing app., the combination of a conveyor for carrying glass articles through a htg. fur., a frame, a tool carrier mounted on the frame for reciprocating movements parallel to the conveyor, a finishing tool mounted for reciprocating movement on said carrier, an article positioner borne by the carrier and movable to and from an article in coördination with the reciprocation of the tool, and connections coördinated with the movement of said conveyor for reciprocating said carrier on the frame and said tool in the carrier.





Means for stirring glass. Charles Algernon Parsons. U. S. 1,479,511, Jan. 1. For use in the manuf. of glass, a stirrer with means for giving thereto a rotary motion about its own axis and an orbital movement, substantially as and for the purposes described.

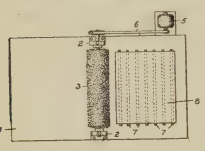
Glass manufacture. Robert M. Corl. U. S. 1,478,554, Dec. 25. In combination means for advancing a set mass of glass, means for applying a converting ht. to the forward end portion of the mass to flow therefrom a sheet of lesser thickness than the mass, means for carrying away the sheet as it flows from the mass, means acted on by the sheet to regulate the htg. means to maintain a substantially uniform flow of glass from the mass, and means for supplying glass to the rear end of the mass to maintain its continuity and the continuity of flow of glass therefrom.



Etching compound. Aaron M. Hageman and Julius M. Kovachy. U. S.

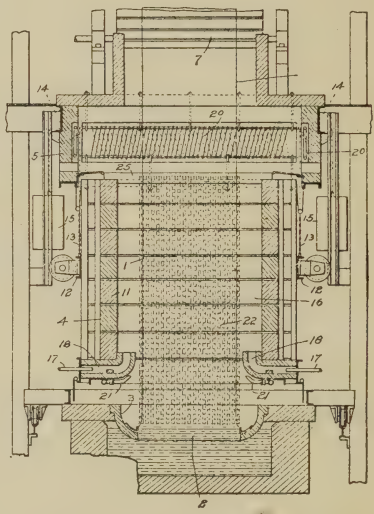
1,471,466, Oct. 23. A compound suitable for etching glass having, as its active ingredient, a harmless acid salt.

Process of polishing glass. CHRISTOPHER BROWN. U. S. 1,480,542, Jan. 15.

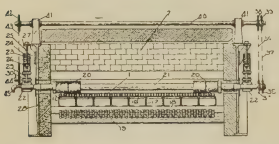


A process of smoothing or polishing a glass sheet which consists in rotating a brush with its axis extending transversely of the sheet and having radially extending fibers with the ends of such fibers in contact with the sheet at a high rate of speed so that the fibers engage the sheet with an impact or whipping action, and supplying an abrading or polishing material to make such action effective to smooth or polish the glass.

Apparatus for drawing sheet glass. ROBERT A. MILLER. U. S. 1,480,625, Jan. 15. An app. for drawing sheet glass from a bath of molten glass, means for drawing a sheet upwardly from the bath, temp. equalizing means in the form of a flexible openwork curtain surrounding the sheet and extending upwardly from the bath, a leer casing surrounding the curtain, and means for applying heat to the interior of the casing.



Apparatus for drawing sheet glass. OTTO C. MILLER. U. S. 1,481,218, Jan. 15. In a machine for drawing sheet glass, a source of molten glass, and means for drawing a sheet of glass therefrom, comprising an endless carrier and flattening table for the sheet, means for driving the carrier, a plurality of cross-shafts above the sheet and table, asbestos rollers carried by the shafts engaging the edge portions only of the sheet, means at either end of the shafts for yieldingly supporting a portion of the weight thereof, means for driving the shafts in unison, and means for internally cooling the shafts and rollers.



Heavy Clay Products

Improvements in drying refractories or other goods. J. HOLLAND AND W. J. GARDNER. *Pottery Gaz.*, **48**, 1799–1801(1923).—See *Ceram. Abs.*, **3** [1], 18(1924). J. W. H.

Up-to-date methods of manufacturing sewer pipe. STAFF ARTICLE. *The Clayworker*, **80**, 30–1(1923).—Article deals with the mfg. process of sewer pipe in the following steps: mining, prepn., molding, drying, setting, firing and glazing. J. W. H.

Grinding and screening clays. J. H. KRUSON. *Brick and Clay Rec.*, **63**, 691–4 (1923).—Water content and size of clay lump has considerable bearing upon the clay prepn. Experience has shown that weathering and preliminary grinding often improves the product and reduces repair costs. Author gives helpful suggestions on prepg. clays and shales, such as proper speed of pan, wt. of mullers, etc. J. W. H.

Essential qualifications of brick pavers. ANON. *Brit. Clayworker*, **32**, 195–200 (1923).—The quality of paving brick was investigated by the Brit. Paving Brick Assoc. by means of rattler tests. Tests were made both of the dry brick and upon the wet

brick. In testing granite block in this manner it was found that the wear on the wet block was about four times as great as that on the dry block. In the case of paving brick, however, it was found that the wet brick tested 10% less in one case. In two other cases the wear was increased $12^1/_4$ and $16^1/_2$%. This proved the important fact that paving brick may be far superior to granite block when wet. This may explain the fact that brick roads are declared to be cleaner than any others, and why they outlast other paving materials. Contrary to what was expected, a brick which had been made by the semi dry process passed as a No. 1 paver and showed less wear when wet than when dry by 10%. It also wears more uniformly than brick made by the stiff mud or soft mud processes. This brick had an absorption of 2.67%. Structure defects revealed by the rattler tests are as follows: laminations, too granular a condition of the substance, softer condition of the interior of the material than the outside, brittleness, and weakness of the stiff mud brick where the clay escape is situated. These defects were found in brick which stood the test as well as in those which failed, so that these are no safe criterion in ascertaining whether a brick will stand the test or not. It was found that brick when repressed were not improved. The brick lose about as much in the first 450 rev. as they do in the subsequent 1350 rev. as is shown below:

First 450 rev.	Total of 1800 rev.	Times
7.8	17.8	2.28
6.6	17.9	2.71
10.6	26.6	2.51
10.8	25.7	2.38
12.0	31.8	2.65
12.7	33.8	2.65
13.3	35.8	2.70
17.5	46.1	2.63

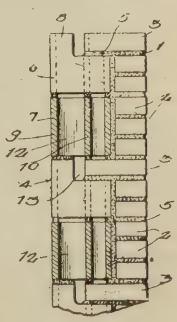
H. G. S.

Bricks from oil-shale. ANON. *S. African Jour. Indus.*, **6**, 324(1923).—Extensive deposits of oil-shale are found in Germany but, owing to their small oil-content, their development presents many difficulties. A method has recently been proposed for utilizing these shales to make a cheap building material; the shale is ground and mixed with sand or clay, the proportion depending on the richness of the shale. Bricks of this mat. are shaped and placed in a kiln. where they are baked by the combustion of their own oil. The bricks so obtained contain only small quantities of calcium sulphate and sulphite, and are as hard as ordinary bricks, from which they differ little in appearance. O. P. R. O.

Heat economy in sand-lime brick plants. ANON. *Arch. Wärmewirtschaft*, **4**, 96–100(1923).—Details are given of the distribution of the heat used in 2 plants; the fuel consumption could be reduced $^1/_3$ by proper equipment.

E. W. T. (*C. A.*)

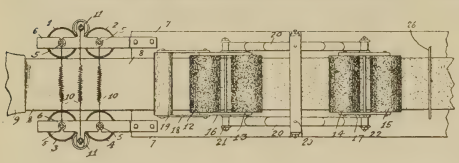
PATENTS



Composite brick and tile wall construction. WILLIAM GUSTAVUS DEMAREST. U. S. 1,479,379, Jan. 1. A composite brick and tile wall construction comprising, in combination with a brick facing having ordinary courses and header courses, a plurality of complementary courses of tile arranged behind each group of ordinary courses comprehended between adjacent header courses, certain of the tile having reduced extensions disposed behind said header courses, the tile and the reduced extensions having continuous vertical openings therein constituting suitable vertical

air passages through the wall and serving to dissipate the moisture finding its way in through the wall.

Process for surfacing clay products. EMMETT V. POSTON. U. S. 1,477,663, Dec. 18. A process of surfacing plastic substances consisting in passing the plastic bar between a series of press. rolls having granular surfaces of varied degree of coarseness, and subsequently severing the substance into building elements.



Refractories

How to make good silica brick. E. E. AYARS. *Brick and Clay Rec.*, **63**, 550 (1923).—A. discusses each step in detail, beginning with the selection of the raw mat. and following it to the final inspection. Hard quartzite coming from either the floe or ledge and containing 97–98% silica produces a strong brick of high refractoriness. Only sufficient raw mat. should be stored at the plant to insure a steady supply; any advantages gained by additional amounts is lost because of the increased overhead. Gyratory crushers are favored over the swinging jaw type. Finer crushing is suggested; it may increase production, lessen the wear on the grinding pans, or permit the use of lighter equipment. Underdriven pans with wearing parts of 2% manganese steel are recommended. The batch usually contains 8–40% of bats, 20% being very common. 5% of sand is sometimes added to reduce plasticity. The dry process of grinding is mentioned as a means of obtaining a more uniform grind but more careful standardization of the wet process and the use of ammeter charts is favored. A coarse grind is used to withstand the fluctuating temp. of the open hearth; finer grinds give better workmanship and a tougher brick for use in coke ovens. European manufacturers add 25% of impalpable powder (200 mesh) in order to obtain more rapid conversion to tridymite. Fresh lump, hydrated, or air-slaked lime all give a satisfactory bond. The details of lime slaking, mud storage, distribution, and brick molding are discussed. The molder can only be held for poor slicking and spongy corners. Rusting of pallets discolors brick; it may be overcome by painting with cheap cylinder oil or using enameled pallets. Vent bottom molds are used for small shapes, slip liner molds for large ones. In Germany 600–2500 small shapes are made per hour on the hydraulic press, under a pressure of 4000 lbs. per square inch. Amer. toggle presses are not very successful as they exert a press. of only 1000 lbs. per sq. in., whereas at least 1500 lbs. is necessary. Proctor driers are satisfactory for drying standard brick in 24 hrs. Tunnel driers operating at 200–325°F give good results in forty-eight hours; the lower temps. and longer time give least breakage. Brick entering the driers semi-dry give more trouble than those freshly made. Waste-heat driers are difficult to operate. Hot floors are very good especially for shapes; they are flexible and the product is strong. Good ventilation above the floor and exhaust pipes below are necessary to prevent condensation. Kiln construction is discussed. A 32′ kiln with a 19-day turnover is favored over a 40′ kiln with a 26-day turnover. Emphasizes regular cleaning of flues, flexible flash walls, and thick wickets. Under setting he gives details of foundation, benches, protection from flame, hot spots, allowance for expansion, and reduction of breakage. In heating up he advises a temp. increase of 33°F per hour up to 1500°F; at higher temp. less care is necessary. High volatile coal, slightly clinkering, low in sulphur, 14,000 B.t.u., is recommended. 1.6 T. per M. is mentioned as being necessary with round down-draft kilns to cone 18, 2.0 T. per M. to cone 20. Smaller amounts are used in Europe by burning to cone 15 in a Hoffman kiln. Cold spots are due to poor draft. He attributes 90% of breakage to rough handling, imperfect molding and drying.

10% to burning. This paper is original and of particular value in that it attacks the problem from the practical mfg. standpoint. R. M. H.

Carbonization of clays. W. SMITH. *Min. and Met.*, **4**, 606(1923).—Abstr. of paper before Refrac. Mat. Sec. of Ceramic Soc. of England. S. shows that by satg. clay, at a certain stage of heating, with hydrocarbon gases or volatile hydrocarbons under press., the gases dissociate and deposit very finely divided carbon on the particles of clay. This occurs during the "biscuit" period when the clay has max. porosity and before firing contraction has set in. The clay thus carbonized is black and when contraction takes place during heating in the final stages of firing, great pressure is exerted on the enclosed particles of carbon and a dense, hard, composite body is formed. By firing in a strongly oxidizing flame this product may be converted into a microscopically porous structure, owing to burning away of the carbon, the refrac. properties being highly increased. For the black carbonized clay the term "carbonite" is suggested for indus. purposes. It is best adapted for abrasives, mixing with cement, roadmaking, etc.; it is refrac. to heat in absence of air and resistant to acids, as well as impervious to atmospheric action. For the white clay, from which the carbon has been burned out, the term "carbo-calcined" clay is suggested. Its refrac. properties are due to the artificially produced porosity and it usually does not melt at anywhere near the same temp. as the original mat. The durability of carbonized brick in indus. fur. is much greater than that of bricks made of untreated clay. Binding is accomplished by pressure, as with magnesite. Artificial binders should be used sparingly and with carbo-calcined mats. the binder should preferably be of the same compn. as the original clay. Carbonization increases the normal function of sillimanite. By special treatment of certain clays, the production of a brick, retort, and crucible consisting mostly of sillimanite has been accomplished on a small scale. Bricks of carbonized clay possess refractoriness and hardness and exhibit little or no contraction or expansion. See also *Ceram. Abs.*, **2** [8], 182(1923). R. J. A.

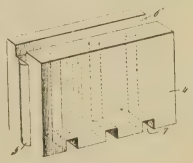
Bauxite cements (Ciments fondus). GABRIEL PATROUILLEAU. *Le Ciment*, **28**, 259–60(1923).—It is suggested that the bauxite cement of av. percentage compn. SiO_2 12, Al_2O_3 44, CaO 44, with a corresponding mol. compn. 1 SiO_2, 2 Al_2O_3, 4 CaO is a very basic oxysilico-aluminate of lime, which may be written SiO_2, Al_2O_3, CaO + mAl_2O_3 + nCaO. L. N.

Refractories in the steel industry. J. S. MCDOWELL. *Blast Fur. & Steel Plant*, **11** [11], 569(1923).—The phys. and chem. properties of the refrac. used in the blast fur. and steel indus. are listed and discussed, together with some notes on their requirements for use in various parts of different types of fur. employed in the indus. C. R.

Appalachian bauxite deposits. W. A. NELSON. *Bull. Geol. Soc. Am.*, **34**, 525–39 (1923).—Upon boiling bentonite, formed from altered volcanic ash, with H_2SO_4, practically all of the Al_2O_3 goes into soln. Treatment with tannic acid will then cause the Al_2O_3 to ppt. These expts., it is claimed, show "that the bentonite may very readily be the source of the Al_2O_3 in the bauxite deposits of the Appalachian region." W. F. H. (*C. A.*)

PATENTS

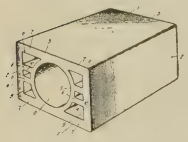
Refractory composition. JOHN L. OHMAN. U. S. 1,479,107, Jan. 1. A refrac. compn. for ht. resisting articles, comprising silicon carbide and fused silicon oxide, and cryst. graphite. See also *Ceram. Abs.*, **2** [10], 226(1923).



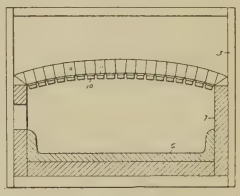
Baffle brick. FRANK H. WAITE. U. S. 1,478,309, Dec. 18. In a device of the class described, a brick comprising a rectangular body having a longitudinally extending channel in one longitudinal face thereof and a transverse channel in its opposite

face, and an internal conduit connecting said channels. See also *Ceram. Abs.*, **3** [1], 15(1924).

Building tile. WILLIAM J. GILBERT. U. S. 1,477,258, Dec. 11. A building tile of the character described comprising rectangular outer wall portions, and inner web portion connected with said outer wall portions, all said inner web portions being thinner than any of said outer wall portions, said webs being arranged so as to provide a large central opening, and smaller side openings, said side openings comprising larger corner openings and smaller intermediate openings.

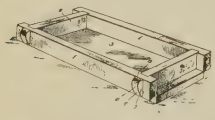


Process for manufacturing new and improved high refractory. CHARLES JAMES CRAWFORD. U. S. 1,477,810, Dec. 18. A silica brick consisting of tridymite bonded with a clay of high alumina content. The herein described method of mfg. a fixed volume high refrac. substance which consists of burning a silica material in a kiln the atmosphere of which is charged with a gaseous catalyzer formed independently of the material being treated.

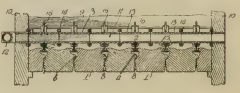


Metallurgical-furnace roof. CHARLES JAMES CRAWFORD. U. S. 1,477,811, Dec. 18. A fur. roof of refrac. material of staggered checker work construction.

Fire-brick mold. ROBERT L. KINTON and AMOS F. HIBNER. U. S. 1,478,746, Dec. 25. A mold comprising a bottom and encompassing walls and entirely open at its top to permit of unrestricted discharge of the molded product when the mold is completely inverted, the mold being provided upon one of its said walls with spaced rockers to engage a surface upon which the mold is to be overturned, the said rockers having accurate tread surfaces, the tread surface of each rocker, at one end, terminating substantially at the normally lower edge of the wall upon which the rocker is provided and at its other end merging substantially with the normally upper edge of said wall, the said tread surface of the rocker throughout its length describing a substantially cycloidal curve the higher portion of which is nearer the open top than the bottom of the mold.



Fire arch. HERMAN A. POPPENHUSEN. U. S. 1,477,895, Dec. 18. In a fire arch a plurality of laterally spaced beams, a plurality of rows of tiles, one row in each of the spaces between said beams and suspended therefrom, a plurality of conduits above said beams and adapted to have a cooling medium circulated therethrough, said conduits extending across said beams, and means carried by said conduits and engaging said beams for suspending the same from said conduits.



Whiteware

Production of porcelain for electrical insulation. F. H. RIDDLE. *Jour. Am. Inst. Elec. Eng.*, **42**, 988–94(1923); cf. *Ceram. Abs.*, **3** [2], 49(1924).—Deals with the firing of elec. porcelain. Methods of measuring temp.—thermocouples, pyrometric cones and shrinkage bars—are described, and the defects of periodic kilns dwelt on, these being chiefly loss by radiation and lack of recuperation and irregularity of draft which causes non-uniform temps. among saggers. A full description of the muffled tunnel kiln (Dressler) is given, with photographs of loading platform, entrance end and combustion chambers, together with a diagram of cross-section through the hot zone and a typical time-temp. record. In addition to economy of fuel, which may mean a saving of as much as 80% over the amount used in periodic kilns of equal output, the tunnel kiln

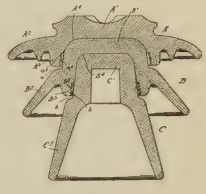
offers other advantages such as continuity of operation, slower deterioration of the brickwork, uniformity of ht. treatment and ease of loading and unloading. In discussing the mechanism of Dressler kiln, emphasis is laid on the need of maintaining very low draft velocity, both as regards air for combustion and the waste gases, and the equalization of temps. in the hot zone by convection, which is made possible by the circulation of air in the hollow carborundum chambers. The article is, on the whole, a distinct contribution to the physics of the tunnel kiln. A. F. G.

PATENTS

Improvements in refining clay, especially china clay. English Pat. 184,880. *Chem. Age*, China Clay Trade Rev. Sec., **15**, (1923).—Kaolin residues are treated with 86 pts. water contg. 1 pt. of potash water glass in soln., for 5 to 10 min. in a colloid mill and then allowed to stand for $^1/_2$ to 1 hr. in a tall vessel. In this time the whole of the silicates have been pptd. and particularly pure kaolin is present in fine suspension which is so fine that it shows Brownian movement in the ultra microscope and remains suspended for a long time. This was not to be foreseen since it was known that the above kaolin residues are at present considered waste products which have to be thrown away. The above process, however, allows of the recovery of as much as 40% kaolin, and more, while the silicates which are simultaneously obtained are also of high value. O. P. R. O.

Improvements in or relating to manufacturing of china clay. ANON. English Pat. 188,010. *Chem. Age*, China Clay Trade Rev. Sec., **9**, 15(1923).—A method of mfg. china clay according to which clay of large water content is pptd. as by settlement in a tank, centrifugal sepn. or the like, and the sepd. water is removed until a desired av. consistency is reached, after which the densest clay is removed from the pptd. layer, say, by suitable conveyor or other detaching means, without removal of the wetter portion, and the drying of said denser clay to any desired degree is completed upon a surface htd. by compressed evolved vapor. A drier is continuously supplied with clay of the desired uniform consistency, say by the combined opern. in sequence of a plurality of settling tanks, having mech. removal devices, centrifugal sepg. means or the like. The clay is refined by carrying it as a fine powder in a moving gaseous medium from which it is deposited in a selected condition.

O. P. R. O.



Insulator. BENTLEY A. PLIMPTON. U. S. 1,478,912, Dec. 25. An insulator comprising a plurality of nested hollow sections having closed ends, the outer surface of the sides and end of the inner section fitting closely against and contacting with the inner surfaces of the sides and end of the outer section, one of the sections having a recess formed in its side opposite the adjacent surface of the coöperating section, and a cementing medium in said recess.

Equipment and Apparatus

A cheap electric resistance furnace of the tube type. H. FORESTIER. *Bull. Soc. Chim.*, **33**, 999–1000(1923).—A tube type fur. which is capable of htg. to 1000° in 30 min. and drops to 100° in $1^1/_2$ hrs. after turning off current is described. Around a metallic tube (3–4 cm. diam. for example) is wrapped a piece of paper. Over this is wound the resist ($3^1/_2$–4 m. of nichrome wire $^1/_2$ mm. diam.). The resist. winding is covered with a thin coat of alundum 1 to 2 mm. thick. This is htd. several min. in an oven. When dry the tube is placed vertically in a cylinder of asbestos paper and the space between filled with rapid setting cement. It is dried in the air some hrs. and then covered with asbestos insulation 3 to 4 cm. thick. It is then heated by passing a current through the resist. This chars the paper and allows the metallic tube to be

pulled out. Under the writer's conditions using 110 v., 4.5 amp. or about $^1/_2$ kw. were consumed. W. R. K.

The standardization of commercial viscosimeters. MADISON L. SHEELY. *Jour. Indus. Eng. Chem.*, **15** [11], 1104(1923).—The need of the standardization of viscosimeters and the advisability of expressing results in abs. units, is discussed. Method of calibrating and set up and operation of a typical glass outflow type of viscosimeter is given, with comparisons of various similar types. Calibration of the MacMichael, or torsional viscosimeter for a single range of viscosity is given and comparison with other types made. Results on the MacMichael viscosimeter indicate uniformly higher viscosities than obtained with out-flow types of colloidal solns. The suggestion is made that the lower velocities in the former have less effect in breaking down the colloidal aggregate, or cause a difference in rate of shear, resulting in apparent discrepancies in the absolute viscosity detn. with the 2 types. Results on true solns. compare quite well in both types of app., which lends force to the suggestion. A brief discussion of solns. suitable for use in calibrating viscosimeters is given. In general, non-volatile oils are recommended for this purpose for comparatively high viscosities.

R. D. L.

Notes on the Proctor drier. A. H. MIDDLETON. *Brit. Clayworker*, **32**, 226–31 (1923); Also *Pottery Gaz.*, **48**, 1803–4(1923).—For abstract see *Ceram. Abs.*, **3** [1], 19 (1924). R. D. L.

A new air preheater. F. S. N. HEWARD. *Combustion*, **9** [5], 393(1923).—Heat is carried in a mech. way to air for combustion. A fan draws fresh air into the upper portion of a casing which is divided in two parts by a vertical partition. The air is confined to one side of the partition, passing downwards to a similar semi-circ. chamber through a porous drum or rotor, and then to fur. Hot flue gases pass in opposite direction through rotor in second chamber, and to stack. Rotor transfers ht., and moves about 6 r.p.m., being made of thin sheet steel, and divided into sectors by radial plates. Ease of cleaning, no serious effect due to deposition of soot and tarry matter, and liberal htg. surface with very little obstruction to passage of air and gases in comparatively small dimensions pointed out. C. R.

Induction furnaces for non-ferrous metals. EMILE DEMENGE. *Rev. métal.*, **20**, 448–52(1923).—After a brief outline of the merits of induction furnaces, D. described in detail a furnace used by the Compagnie Française des Métaux which can effect continuous or variable agitation of the molten metal, allows of decanting clean metal, reduces oxidation and radiation losses to a min., and can be connected directly and simultaneously to the 3 phases of an ordinary circuit with an acceptable load factor. Also in *J. four élec.*, **32** 53–5(1923). A. P.-C. (*C. A.*)

Constant-temperature regulator for electric furnaces. JEAN SOLARI. *Bull. soc. chim.*, **33**, 1000–4(1923).—A device is described for maintaining const. within ±5° (at 575°) the temp. of a resistance furnace. The regulator is a differential air thermometer actuating a Hg column which connects or cuts out added resistance in series with the main furnace. An auxiliary furnace in series with the furnace to be regulated contains the hot bulb of the differential thermometer. The main furnace is thus entirely free of obstructions. The auxiliary furnace has little thermal lag, thus causing the regulator to respond promptly to variations in the furnace current.

L. J. (*C. A.*)

A simple method of optical pyrometer calibration. FR. PATZELT. *Z. Physik*, **15**, 409–12(1923).—The positive crater of the carbon arc, like various standard combustion lamps, can be used as a standard of luminous intensity and therefore, with optical pyrometers, of effective temp. To this end it is necessary that the carbon should be of definite purity, and the current between 0.2 and 0.5 amp./mm.^{2} A very pure carbon is

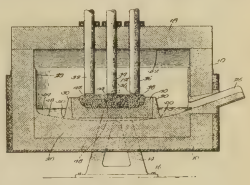
naturally best. A pure carbon (mark "A" of Gebrüder Siemens & Co., 6 mm. in diam., with 15 amps.) gives a "black temp." of 3780°K. Errors may come from inaccurate optical arrangements, from impurity, and from the photometric adjustment.

W. P. W. (*C. A.*)

A new centrifugal for separating solids from liquids. C. R. Platzmann. *Chem.-Ztg.*, **47,** 167–8(1923).—A description, with 5 cuts, of the app. of the Centrifugal Separators, Ltd., London, which combines features of the centrifugal and filter-press. The advantages of the app. are: low 1st cost, low operating cost, can handle suspensions for which presses are not suitable, independent of temps., small floor space, and the sepn. of the solids according to size of grain. J. H. M. (*C. A.*)

PATENTS

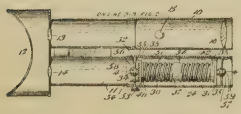
Electric melting furnace. Alfred W. Gregg. U. S. 1,477,821, Dec. 18. In a device of the class described, a fur. chamber inclosing a hearth, sloping continuously downward from the side walls of the chamber towards its center, a central island in the hearth, and means for creating an elec. arc on the island without passing elec. current through material to be melted on the hearth. See also *Ceram. Abs.*, **2** [7], 166(1923).



Means for producing a sooty vapor in electric furnaces. George M. Little. U. S. 1,477,372, Dec. 11.—An elec. fur. comprising a plurality of walls enclosing a fur. chamber, a carbonaceous resistor located in said chamber, a plurality of feed-pipes entering said chamber and a single means for permitting a fluid sooty-vapor-producing agent to enter said chamber through one pipe and a fluid oxidizing agent through the other pipe.

Electric resistance furnace. George M. Little. U. S. 1,479,143, Jan. 1. In an elec.-resistance fur., in combination, a plurality of refrac. walls inclosing a fur. chamber, a plurality of refrac. muffle tubes extending through said chamber, and a relatively narrow, elongated refrac. resistor member located in the chamber below said muffle tubes and extending transversely thereof, thereby obtaining a predetd. temp. gradient from the intermediate portion of said muffle tubes to the ends thereof. See also *Ceram. Abs.*, **2** [9], 205(1923).

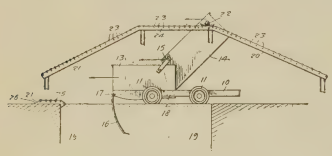
Optical pyrometer. Richard P. Brown and Charles P. Frey. U. S. 1,476,486, Dec. 4. In an optical pyrometer comprising in combination, a light standard, a rheostat arranged to vary the intensity of said standard, a scale representing temp. or temp. equivalents having a calibrated relation with respect to said rheostat, said light standard and said scale being simultaneously visible, and means to move said scale and rheostat in synchronism.



Electric resistance furnace. Thomas A. Reid. U. S. 1,477,384, Dec. 11. An elec. fur. structure comprising an open ended and open top metallic casing, a removable metallic top plate for said casing interlocked therewith, an outer base plate, two spaced apart outer side plates, and an outer top plate inside of said metallic casing, all of said plates being of refrac. ht.-insulating mat., an inner base plate, a pair of spaced-apart inner side plates and an inner top plate, all located inside of said ht.-insulating plates and comprising refrac. high-temp. resisting mat., and spaced apart to provide a fur. chamber, and a htg. element for said fur. chamber comprising a plurality of relatively thin refrac. plates constituting a lining for said fur. chamber and a resistor member held in proper operative position in said fur. structure by said thin refrac. plates in coöperation with the plates constituting the inner lining.

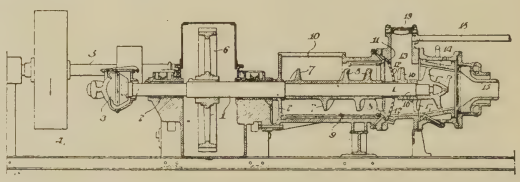
Electric furnace. THOMAS A. REID. U. S. 1,477,385, Dec. 11. In an elec. fur., in combination, a plurality of walls enclosing a fur. chamber, a plurality of relatively thin refrac. plates constituting the lining of said chamber, and relatively thin, shaped, refrac. members located between the adjacent edges of the refrac. plates, and independent of said walls for maintaining them in proper operative positions relatively to each other. See also *Ceram. Abs.*, **2** [6], 136, [9], 207(1923); *Ibid.*, **3** [1], 20(1924).

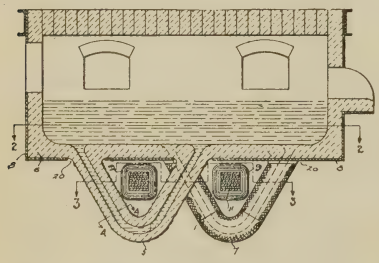
Electric furnace. ORA A. COLBY. U. S. 1,477,313, Dec. 11. An elec. fur. comprising a supporting means and a resistor rod having a plurality of integral flattened portions located in said supporting means.



Dumping vehicle. ROBERT C. BLEDSOE. U. S. 1,476,871, Dec. 11. In combination, a wheel supported frame, a relatively stationary body portion carried by the frame and provided with a hinged bottom, a tiltable body portion carried by the frame and having a lip supporting the free end of said hinged bottom, the tilting of said tiltable body releasing said hinged bottom, and means for tilting said tiltable body.

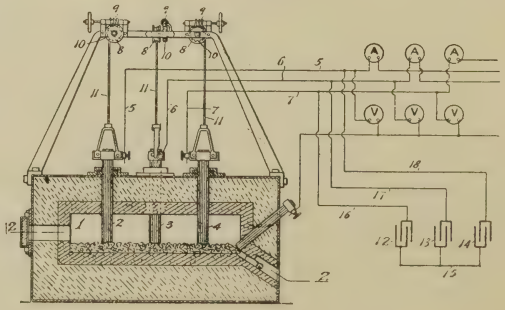
Method and means for working clay. RALEIGH H. STALEY. U. S. 1,478,842, Dec. 25. The method of treating clay, which consists in introducing the clay in a plurality of relatively small streams into an enclosed space, exhausting the air from said space and then extruding the clay therefrom. In a device of the character described, the combination of means forming an enclosed chamber provided with an extrusion orifice, means for forcing clay into said chamber in a plurality of separated streams, means for exhausting air from said chamber and means for extruding the clay therefrom.





Induction furnace. CHARLES A. BRAYTON, JR. U. S. 1,479,582, Jan. 1. In an induction fur., the combination of a bath, a closed channel of uniform cross-section thereunder and connected therewith and leading to and from the bath, said channel having a comparatively thin wall of substantially even thickness throughout its length and surrounded by a pervious metallic jacket, whereby said wall may be maintained at a relatively cool temp. to prevent permeation of the molten metal through the channel wall.

Electric furnace. MORRIS H. BENNETT. U. S. 1,478,375, Dec. 25. The combination with a fur. for melting metals, of means for delivering a main htg. current directly to the charge in the fur. and means for impressing on said main current a htg. current of high



frequency, the resulting current producing improved htg. effects in the fur. due to the resistance of the charge to said current.

Kilns, Furnaces, Fuels and Combustion

The application of tunnel kilns in the firing of ceramic wares. C. B. HARROP. *The Clayworker*, **80,** 34(1923); *Brick and Clay Record*, **63,** 18–19(1923).—An address given at the summer meeting of New Jersey Clay Workers Association and Eastern Section of the AMERICAN CERAMIC SOCIETY. H. brought out that in the use of the tunnel kiln as compared with the periodic operation, there is a saving of 50 to 85% in fuel. Moreover, a higher type of kiln burner is necessary for successful operation of tunnel kiln. A chart was presented (given below) which set forth all tunnel kilns of different types, that have been constructed and operated with more or less success during the past 13 years.

Character of ware	No. of kilns	Character of ware	No. of kilns
Vitreous China	3	Brick and Hollow Tile	15
Semi-porcelain	9	Drain Tile	1
Sanitary Ware	14	Roofing Tile	2
Cooking and Art Ware	1	Electrical Porcelain	8
Stoneware	2	Carbon Electrodes	3
Refractories	6	Abrasives	1
Floor and Wall Tile	12	Specialties	2
Terra Cotta	1		

J. W. H.

Oil firing of clay products. W. D. RICHARDSON. *The Clayworker*, **80,** 142–3 (1923).—On basis of heat units 1 T. of fuel oil is approx. equiv. to 1.46 T. of coal, but on basis of actual opern. 1 T. of fuel oil is equiv. to 1.79 T. of coal. Using this latter figure and considering av. wt. of fuel oil as 7.7 lbs. per gal. the following table gives the equiv. prices of coal at kilns and of oil in storage at kilns.

Oil, price per gal.	Coal, price per ton	Oil, price per gal.	Coal, price per ton
0.02	2.91	0.055	7.99
0.025	3.63	0.06	8.72
0.03	4.36	0.065	9.44
0.035	5.08	0.07	10.17
0.04	5.81	0.075	10.89
0.045	6.54	0.08	11.62
0.05	7.26		

Advantages of fuel oil are given. (1) An equal wt. of oil can be stored in approx. $^2/_3$ of space required for coal, and an equal vol. of oil has 50% greater heating value than coal. (2) Fuel oil does not deteriorate in storage to any appreciable extent. Coal deteriorates in storage. (3) No ashes, clinker or dirt when oil is burned. (4) Smoke almost entirely eliminated. (5) Oil handled cheaper than coal; no handlers or stokers req. (6) A more intense heat can be secured with oil. Also, a more uniform ht. and better regulation. No opening of fur. doors, with an inrush of air and no lowering of temp. from cleaning of fires. (7) A smaller per cent of excess air is required, hence a smaller vol. of waste gases and greater economy. (8) Flue gas analysis shows less fuel is lost through stack. J. W. H.

Oil firing clay products. W. D. RICHARDSON. *The Clayworker*, **80,** 340–2(1923).—Article deals with the atomizing of oil. The three main atomizing systems used are: (1) steam, (2) air, (3) mechanical. The fundamental factors are delivery of oil at a

uniform pressure, free from water and foreign matter, absolute control of all the fuel and air entering the fur. and regulation of the air in propn. to the fuel req. Cuts are given of several burners on the market. J. W. H.

Maintenance and rebuilding of round down-draft kilns. E. E. Ayars. *Brick and Clay Rec.*, **63**, 181–5(1923).—Experience indicates that, when a brick kiln shows age, it pays to rebuild it throughout. Some reasons are given in the discussion of rebuilt kilns (32 ft. pit kilns). This type of kiln has various disadvantages, but affords increased setting capacity and the small flues are more easily cleaned. Foundation is concrete. Tunnel is almost entirely silica brick which is recommended also for the floors and flues. Washing the interior with a clay slip is advantageous if pure high grade clay is used, a high alumina wash gives good results as it does not glaze readily. Repair clays and washes should contain at least 25% of fire-brick bats or calcine ground with clay. Repair clay should pass a 20-mesh and washes through a 30-mesh screen. Shrinkage cracks should be filled with grog to which a small amount of plastic clay is added. J. W. H.

Insulation of kilns. J. H. Kruson. *Brick and Clay Rec.*, **63**, 22–6(1923).—This article deals with insulation (diatomaceous earth) of walls and crowns of down-draft kilns, used in firing fire-clay refractories. A report from 25 plants using crown and wall insulation estimates a fuel saving from 15 to 25%, while for crown insulation, only 10 to 15% is reported. The total furnace area could be reduced 10% and there would still be sufficient capacity for proper burning. Improved quality of ware is reported. Several graphs showing heat losses through various kiln walls (insulated and bare) and types of crowns accompany the article. Tops should be left bare for two burns to allow for settling, and then should be waterproofed. By proper insulation the wall thickness may be reduced about one-third. J. W. H.

The practical use of oil fuels. A. F. Brewer. *Combustion*, **9** [5], 379(1923).—Prac. suggestions are given on cleanliness, fire hazard, ventilation, soot blowers, pumping and straining, repairing leaks, and flaming at stack. Burners extinguished by clogging, water in oil, too great amt. excess air, occasional slugs of air in oil line. Explosion and flareback caused by attempting to relight from seemingly hot wall, accumulation of explosive gases from leaky burner valve, insufficient ventilation of fur. prior to lighting. Steam and air atomization with air chamber requires 30-50 lb. press., without, 100 lb. press. or over to avoid pulsation. Dry steam is necessary or flame sputters. Mech. atomization requires approx. 150 lbs. press. and oil at nearly const. temp. and press. C. R.

Efficient use of liquid fuel. H. A. Anderson. *Foundry*, **52** [1], 29–30(1924).—The efficiency of an oil burning system is greatly dependent on the type of burner, its location in the fur. and the oil and gas press. employed. Insulation shows small savings on fur. operated a few hrs. each day. Light colored surfaces cut down radiation losses. Oil feeding systems are discussed, and the circulating system with a rotary pump recommended. M. E. M.

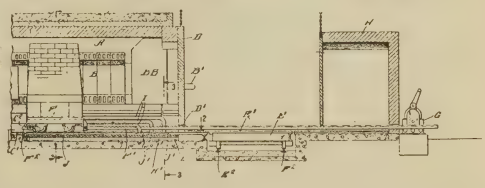
Excess air and fuel consumption in kilns. P. Thor. *Tonind. Ztg.*, **95**, 723–4 (1923).—Firing control app. may often be purchased for the price of 3000–4000 brick which will make it possible to save 30% fuel. This app. is the draft gage which has become indispensable to the brick indus. The draft gage, however, merely gives the variations in draft and does not tell us the compn. of the gases. The CO_2, O_2, CO, and N_2 contents of the chimney gases may be detd. with an Orsat app. or a Cramer chimney gas tester. It is possible to make 20 detn. per hr. with one of these. In regular firing practice it was found that variations in the chimney gases do not always occur in kilns having different diameters but may also occur in the same kiln for reasons not always explainable. Gas anal. of the chimney gases at frequent intervals is the only

safe way to control kilns. In general it may be said that kilns performing the best give a comparatively high anal. for CO_2, this being 7–8%. Poorly performing kilns have a content of CO_2 in their chimney gases varying from 2 to 4%. Where the gas analyses shows a low CO_2 content it indicates that the draft is too strong and considerable fuel is wasted due to the htg. up of excess air. In such cases the resist. to draft should be increased this being most conveniently done by lowering the damper.

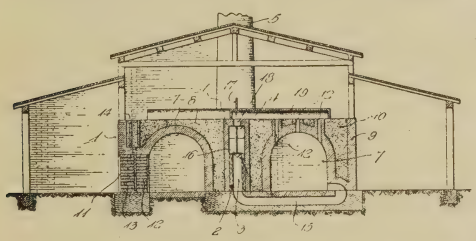
H. G. S.

PATENTS

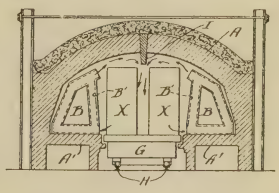
Tunnel kiln. HARRY M. ROBERTSON. U. S. 1,477,152, Dec. 11. The combination with a continuous tunnel kiln and the goods carrying cars movable through it, of means for withdrawing the goods carrying cars from the exit end of the kiln comprising a dummy car, means for moving the dummy car into and out of the kiln at its exit end, and means for detachably coupling the dummy car to the goods carrying car.



Brick kiln. BAPTISTE F. CANAVERA. U. S. 1,479,368, Jan. 1. A kiln comprising a central wall whose upper portion is hollow and forms a horizontal flue leading to a stack, the lower portion of said wall having vertical passages in valved communication with the flue and the upper portion of the wall having inlet passages; a continuous tunnel surrounding said central wall and having down-draft flues in its bottom discharging into said vertical passages, the outer wall of said tunnel having temporary fire openings while the crown of said tunnel is formed with fuel feeding openings; and arched transversely disposed conduits resting removably on and extending between the crowns of said tunnel and said horizontal flue, said conduits being in communication with said fuel feeding openings and the upper inlet passages of said horizontal flue whereby to establish communication between the upper portion of the tunnel and the horizontal flue when said conduits are in place.



Continuous tunnel kiln. LAURENCE ARTHUR VINCENT. U. S. 1,477,675, Dec. 18. In a continuous tunnel kiln comprising an elongated kiln chamber with a goods pathway therethrough and combustion chambers extending longitudinally of the kiln chamber at opposite sides of the goods pathway in the high temp. zone of the kiln chamber, whereby the goods are largely htd. by a convection current circulation of the kiln atm. upwardly past the combustion chambers and downward in the central portion of the goods pathway, the improvement which consists in a longitudinally extending baffle in the kiln chamber above the goods pathway.



Geology

Marketing of talc. RAYMOND B. LADOO. *Eng. Min. Jour. Press,* **113,** 963–5 (1922).—Lists, uses, markets and methods of marketing. Describes briefly properties

of crude talc from Vermont, New York, North Carolina, California, Canada, France and Italy. Notes absence of standard specifications. S. L. G.

Soapstone deposit in Ontario. AURION. *Eng. Min. Jour.-Press,* **114,** 1071 (1922).—Wabigoon Soapstone Co., Ltd., organized to develop deposit 200 miles N. W. from Fort Williams. Said to be only workable deposit of soapstone known in Canada. S. L. G.

Non-metallic mineral wealth of Russia. SYDNEY H. BALL. *Eng. Mining Jour.-Press,* **114,** 985–9(1922).—A résumé of resources with historical sketches of production of several minerals. Brief descriptions of distribution and geology of coal, petroleum, clay, salt, asbestos, magnesite, barite, diatomaceous earth, etc. S. L. G.

Feldspar. ANON. Dept. of Mines (Western Australia), *Ann. Rept.*, p. 72(1922).—Feldspar occurs as the chief constituent of a big pegmatite dyke situated near Jacob's Well. A large quantity could be obtained by means of a quarry or open cut. It is slightly kaolinized, suitable for use in pottery and enameling trades. O. P. R. O.

Magnesite. ANON. Dept. of Mines (Western Australia), *Ann. Rept.*, p. 70 (1922).—Deposits of magnesite have been found in the vicinity of Coolgardie, samples of which prove it to be of excellent quality for making Sorrel cement. As the demand for magnesite in recent years has far exceeded the supply the new prospect is of considerable economic importance. It is now used in the manuf. of marbleite, which differs from marble in that the lime is replaced by magnesite. O. P. R. O.

Fluorspar lode. E. C. SAINT-SMITH. *Queensland Gov. Min. Jour.*, **24,** 418(1923).—This fluorspar lode, Chillogoe Dist., Queensland, under review is one of the most important deposits of high quality fluorspar yet recorded in the Commonwealth of Australia. It is of comparatively large tonnage, and economically available. O. P. R. O.

Silica sands. ANON. *Indus. Australian and Min. Stand.*, **70,** 707(1923).—Silica sands of Western Australia are known to compare favorably with those found in any other parts of the world. O. P. R. O.

Ironsand. W. DONOVAN. *N. Z. Jour. Sci. and Indus.*, **6,** 140(1923).—In the ironsand of Taranaki the oxide of a new element has been discovered, which it is stated is a refrac. silicate of titanium. Mineralogically, the Taranaki ironsand consists principally of magnetite, ilmetite, ferro-magnesium minerals, such as augite and hornblende, some olivine and quartz; zircon is occasionally present. From the chemical standpoint the most noticeable feature of the sand is the presence of about 10% of TiO_2. D. gives analyses of various ironsands and a summary of the attempts to manuf. iron from these sands; he is convinced that the recovery and utilization of by-products are essential factors in the manuf. of iron from Taranaki ironsand; but if a process could be devised which would not only produce iron, but at the same time recover the titanium dioxide, an exceptionally good pigment, non-poisonous, with a greater covering power than white lead, and ferro-titanium, often a constituent of pottery glazes, the ironsands would be commercially profitable. O. P. R. O.

The lime belt of Massachusetts and parts of eastern New York and western Connecticut. T. N. DALE. U. S. Geol. Survey, *Bull.* **744,** 67 pp.(1923).—Seven quadrangles with their lime deposits are described. The *calcitic limestones* are classified as (1) those used for finishing lime, (2) those not making the best finishing lime, (3) those discarded on account of accessory minerals, and (4) those discarded on account of texture or content of Mg. The *dolomitic limestones* are classified as (1) those used for magnesian lime, (2) those discarded on account of accessory minerals, and (3) those discarded on account of behavior under fire. Chem. analyses of 13 specimens are recorded and 13 photomicrographs of thin sections are shown. The granular and semi-granular dolomitic limestones are described, also the structure exposed in various

quarries. The relations of geologic formation to cost of quarrying and to future prospecting are indicated. L. W. R. (*C. A.*)

Selenium and tellurium. S. Skowronski. *Mineral Ind.*, **31,** 621–5(1922).—A review of production and technical progress, with a bibliography. A. B. (*C. A.*)

Talc and soapstone. F. B. Peck. *Mineral Ind.*, **31,** 658–66(1922).—Markets, trade, production and consumption, and properties are discussed. A. B. (*C. A.*)

Chemistry and Physics

The measurement of thermal conductivity. Ezer Griffiths and G. W. C. Kaye. *Proc. Royal Soc.* (London), **104A,** 71(1923).—Thermal condy. is a phys. const. not capable of ready detn. by simple appliances: the aim in the design of app. described has been to produce an equipment which will give the desired data with min. expenditure of time and labor. Three types of app. are described, for rapid precision detn. of thermal condy. of mats. of low condy.; all three types are modifications of the "plate" or "wall" method to which the stand. equation defining condy. (k), $Q = kA.t - \frac{\theta_1 - \theta_2}{d}$ is directly applicable. App. No. 1 was designed for the study of mats. in the form of discs $^1/_2$ mm. to 4 mm. thick and about 45 mm. in diam. This app. is especially convenient for mats. of a slightly compressible nature, such as cardboard and various hard timbers, which could not be tested between amalgamated plates, owing to the penetration of the mercury into the pores of the mat. App. No. 2 was designed primarily for those mats. of which the contact resistance at the hot and cold plates is high and for which the use of amalgamated plates becomes necessary. The design of the mounting of this app. proved also to be convenient for the study of the variation from point to point in the conductivity over the areas of a large sheet of mat., such as ebonite or micanite. App. No. 3 is a somewhat specialized form of No. 2, adapted in the main for carrying out meas. on mats. which are only available in very thin layers (*e. g.*, certain fabrics, micas, and mica compositions), so that the ht. transmitted for an appreciable temp. difference was very considerable. This necessitated the use of a heavier type of heating coil which was totally enclosed in a block of copper. Energy was supplied by elec. means, a meas. of both the energy entering and leaving the test specimen being made. Temps. were meas. by thermocouples. The samples were thin and no guard ring was required. An average time for the attainment of the "steady state" was 30 min. or less, and the average accuracy of meas. of the condy. was about 1%. Among the points dealt with in the paper are the thermal resistance at the bounding faces of a mat., the effect of superimposing layers of compressible mat., the meas. of the thickness of compressible mat., the dependence of the condy. of timber on structure and the moisture content, the variation of the condy. of rubber with mineral content, etc. The figs., illus. and tables accompanying the paper are very comprehensive, Table 13 giving a summary of the results on the thermal condy. of various mats. O. P. R. O.

Solid solutions. W. Rosenhain. 1250-N (Preprint), Inst. of Metals Division, Am. Inst. of Min. and Met. Engrs., New York meeting, Feb. (1923).—This paper by R. is the second annual lecture before the Inst. of Metals Division of the Am. Inst. of Min. and Met. Engrs. and deals largely with the internal structure and constitution of solid solns. of metals. A solid soln. is defined as a cryst. body formed from a liquid soln. or from an intimate mixt. of solids, or of liquid and solid, that retains in the solid state an admixture of the two subs. (solvent and solute) as intimate as that which exists in a liquid soln. The manner in which solid solns. are formed is considered on the basis of thermal diagrams of equilibrium. While the questions as to how and why solid solns. form have been answered hitherto on the basis of thermo-dynamical formulas,

this does not really give a satisfactory phys. conception of what actually occurs, and R. develops a purely phys. conception. The nature of the solid-soln. crystal is discussed on this basis and as regards its behavior on melting and freezing. It is pointed out that a solid-soln. crystal is a self-strained structure, owing to its lowered m. p. with increasing concentration. This means that the amt. of kinetic energy that must be communicated to the constituent atoms or molecules of the crystal to bring about disruption or melting is lessened by increasing concentration of the solid soln. Therefore, the crystal itself must contain stored-up energy, and the degree of solid soly. must be detd. by the max. amt. of energy that can be stored. Recently, the results of X-ray crystal analysis have thrown an enormous amt. of light on the structure of crystals and of solid solns. X-ray spectographs show that crystals are built up of atoms arranged upon space lattices, and when the atoms of a pure metal are arranged upon a space lattice, whose dimensions are known, there can be no considerable interstices between the atoms. In considering the formation of a solid soln., the question naturally arises as to where the atoms of the dissolved metal go when they pass into solid soln., and the only feasible view appears to be that they take the place of some of the atoms in the solvent metal, upon its own space lattice. Such substitution must produce a powerful effect upon the whole of the lattice, or at least in the neighborhood of the solute atom. This effect is in the nature of a distortion, and such distortion is greater or less, depending upon the similarity, or otherwise, of the solute atom to the solvent. Moreover, the relative amt. of local and general distortion of the lattice will depend upon the nature of the lattice itself. If the lattice is flexible, the distortion is likely to be mainly local, whereas if stiff, local distortion will be resisted and there will be correspondingly increased general distortion. Measurements by Owen and Prestol of the lattice dimensions in the copper-aluminium solid solns. at the copper end show that the differences between the observed and calculated density figures are very small, and their observations are in accordance with the substitution theory. Of course, the number of solute atoms that can be introduced into the space lattice of a solvent must be limited, but this limit depends upon the amt. of distortion that the introduction of each atom produces. The amt. of distortion that a lattice undergoes determines the extent to which the hardness, strength, and ductility of a crystal are affected. Distortion causes a disturbance of the smooth gliding surfaces by means of which plastic deformation takes place, and thus produces a hardening of the metal. Hence, the hardening effect of an alloying element present in solid soln. is approximately inversely proportional to its solid solubility, and a number of examples of alloys are cited to show that this relationship holds. A property of solid solns., even more typical, perhaps, than hardness, which also finds ready explanation on the basis of the substitution theory, is the lowering of the melting point and the spreading of melting and freezing over a range of temperature. Melting can be described as a separation of atoms on the space lattice beyond a definite limiting distance. Where the lattice is perfectly uniform, as in a pure metal, this separation occurs throughout the whole of the crystal at a single and definite temperature. But in a solid solution, where the lattice is either locally or generally distorted, different parts reach their limiting inter-atomic distance, *i. e.*, their melting point, at different temps. Melting, therefore, begins at a temp. which may be considerably lower than that at which the whole of the crystal becomes liquid. When the solvent metal is hard and strong, and the lattice distortion is therefore general rather than local, there is not much difference in temp. between the beginning and the end of melting or freezing; but when the solvent metal is soft, and the lattice distortion is apt to be local rather than general, wide differences are noted. Striking confirmation of the theory is found from consideration of alloys in which the addition of the alloying element causes a rise in the m. p. This is found to be associated with a contraction of

the lattice dimensions, as opposed to an enlargement in the case where the melting point is lowered, precisely as would be expected from the theory. On the basis of the theory, explanation of the mechanism of how diffusion occurs in a solid soln. is given as well as explanations for solid solns. containing several kinds of solute atoms and for the nature and brittleness of intermetallic compds. R. J. A.

Charts for estimating temperature distributions in heating and cooling solid shapes. H. P. GURNEY AND J. LURIE. *Jour. Ind. Eng. Chem.*, **15** [11], 1170(1923).—A number of charts are graphically represented, simplifying the calcns. necessary in detg. temp. changes occurring in htg. and cooling solid shapes. These include unaccomplished temp. change ratios in slabs, cylinders and spheres initially at uniform temp. and approaching another uniform temp., initially at uniform temp. but with the surface temp. uniformly varying from the initial value and momentary values in semi-infinite solids. Where thermal conductivity, thermal diffusivity and surface emissivity are known, or can be assumed, examples of the calcns. involved are given for slabs of rubber and glass and a steel ingot. These illustrate time necessary for arriving at a uniformly higher temp., time-temp. rate of change at any distance from the surface when temp. is suddenly lowered and temp.-time relations at varying distances from the surface when subjected to uniform temp. rise for a definite time. R. D. L.

The proportion and composition of colloidal matter in clay. A. VASEL. *Kolloid. Zeits.*, **3**, Sept.(1923); *Tonind. Ztg.*, **47**, 726(1923).—V. studied the colloidal content of Meiszen kaolin by detg. the per cent of fine clay sol. in an HCl sol. This clay was composed of 32.47% quartz, 65.03% clay subst. and 2.50% feldspar. It had a sp. gr. of 2.583. 10 gms. of clay were boiled in 200 cc. of 10% HCl for 4 hrs. In a 2nd series of tests it was boiled in a 5% sol. of HCl for 6 hrs. In a 3rd series the sol. was first poured off after standing 4 weeks. In each case the residue was had with NaOH (sp. gr. 1.04) in order to remove any silicic acid which may have been formed. The mol. amt. of Al_2O_3 and SiO_2 varies as follows, using Al_2O_3 as unity: 1: 2.08, 2.06, 2.01, 2.19, and 2.22 showing that these constituents are present in the clay in approx. the kaolinite ratio. 3% of mat. was removed from the clay by these treatments so V. concluded that this clay has at least 3% colloidal matter since only the extremely fine grained mat. would be dissolved by this treatment. The clay, however, was equally as plastic after this mat. had been removed as it was before the treatment. Hence it must be that only a portion of these colloids was removed by the treatment.

H. G. S.

Chromium oxide and salts, chromates, barium chloride. A. B. MOND (Chemische Fabril Griesheim-Elektron, Germany). Brit. Pat. 25,720, *Oil & Color Trade Jour.*, **64**, 2186(1923).—Alkali chromates; chromium oxides and salts; barium, chromium, and iron chlorides. Chrome iron ore is converted into ferrochromium in the known manner, the ferro-chromium is dissolved in hydrochloric acid and the chromium pptd. as hydrated oxide by calcium or barium carbonate. The ppt. is sepd. and used to produce alkali chromate, or chromium salts. The filtrate, if barium chromate is used, is evapd. and cooled to separate barium chloride, and the mother liquor may be evapd. to obtain ferrous chloride. In the pptn. of the chromium hydrate it is preferred to use granular limestone or witherite and hot chloride soln. O. P. R. O.

Thermal conductivities of some metals in the solid and liquid states. W. BYRON BROWN. *Phys. Rev.*, **22**, 171–80(1923).—Thermal conductivities of some metals and eutectic alloys above and below their m. p., 50° to about 400°C. A guard ring method of measurement was used. A cylindrical rod of the metal, 1.5 cm. diam. and 12 cm. long was surrounded by a slate tube and outside that a hollow brass cylinder. Both rod and cylinder were independently heated elec. at the top and cooled by flowing water at the bottom so as to maintain the same temp. gradient in both, as shown by thermo-

couples. The input of energy into the rod was corrected slightly for heat leakage and divided by the temp. gradient times the area to get the condy. The conductivities of tin and cadmium decrease at the m. p. by over $^1/_3$ and $^1/_2$, respectively. For thallium, there is a drop of $^1/_{10}$ at about 120°C indicating a polymorphic change. The temp. coeff. are about the same before and after melting, being -5×10^{-5} (Sn), $+21 \times 10^{-5}$ (Cd), $+8 \times 10^{-5}$ (Th). For the eutectics: Sn 0.92, Zn 0.08; Sn 0.62, Pb 0.38; Pb 0.87, Sb 0.13; Pb 0.46, Bi 0.54; the temp. coeff. for the liquids are all positive and have values at 300°C, from .0011 (Pb − Bi) to .0030 (Pb − Sb) close to those found for gases at that temp., indicating that the mechanism is similar in the two cases. Below the m. p. the curves vary, one increasing with temp. (Sn − Zn), two decreasing, and one reaching a max. (Pb − Sb). The sudden decrease on melting varies from $^2/_3$ for (Sn − Zn) and (Pb − Sn) to $^1/_{10}$ for (Bi − Pb). A. F. G.

Thermal conductivities of metal crystals. I. Bismuth. KAYE AND ROBERTS. *Proc. Royal Soc.*, **104A,** 98–114(1923).—All accurate measurements of the thermal condy. of metals have heretofore been made on bars of heterogeneous structure. It was thought desirable to compare the values so obtained with the more fundamental ones given by single crystals. Expts. have been carried out in the first instance on bismuth as it is easy to obtain large crystals and it is one of the few metals that does not crys. in the cubic system. A "plate" type of thermal condy. app. was developed for the purpose. A clearly designed diagram of this app. is given and a detailed description of the construction of the hot and cold plates, the thermal insulation and the surfaces of contact. The results give the thermal conductivities of single crystals of metallic bismuth in directions parallel and perpendicular to the trigonal axis. Two very complete tables indicate these results and are so arranged that each group corresponds to one setting of the specimen. The following are the mean values at 18°C, in c.g.s. units.

Thermal conductivity of bismuth parallel to trigonal axis	0.0159
Thermal conductivity of bismuth perpendicular to trigonal axis	0.0221
Ratio of conductivities	1.39

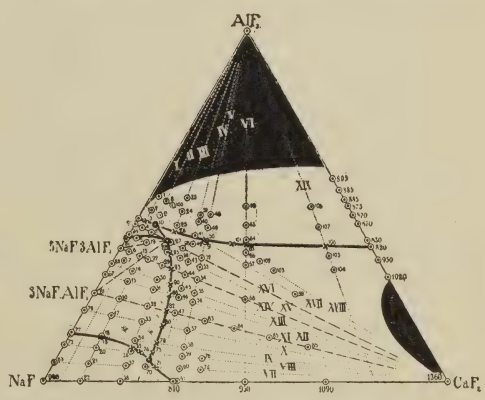
If a random distribution of crystals is assumed, these figures give a mean condy. of 0.0195, which agrees well with the value 0.0193 obtained on bars by JAEGER and DIESSELHORST in 1899. O. P. R. O.

Heat effects on fire clays and their mixtures. SHINJO SATOH. *Sci. Rept. Tôhoku Imp. Univ.*, **1** [3], 156–201(1923).—S. treats the problem from every angle illusg. his remarks with tables and plates. The subject is dealt with under the following headings:—(1) Thermal expansion and contraction. (2) Endothermal and exothermal reaction of raw clay. (3) Detn. of the dehydration point of clay with thermo-balance. (4) The change of the microstructure of clay by heating. (5) Erosion of clay subs. in contact with molten glass. (6) Microstructure of stone. (7) String or cord. The results are summarized as follows: (1) The firing contraction of raw mats. of fire clay is classified into 2 types, one of which expands at a comparative low temp. while the other contracts without a marked expansion. (2) Firing contraction of a fire clay mixt. is the resultant of contractions of the constituent clays. Therefore, the shape of the firing contraction curve and the amt. of the final contraction vary with the mixing ratio of the constituent clays. (3) The thermal change of length of the mold made of fire clays, when heated above a definite high temp., is irreversible. (4) When the mold of clay is htd. at a definite constant temp., the contraction curve of the length satisfies the following equation: $\frac{x}{C-x} = \frac{A}{C-A} - Kt$, where x is the amt. of contraction

at time t, A an initial length of the specimen, C the final contraction after heating infinitely long at a constant temp., and K a constant. Hence we can calculate the final contraction C by means of this equation by three observations. (5) From the results of the thermal analysis, the thermo-balance test, and the microscopic investigation, we can draw the following conclusions:—(*a*) The dehydration of the constitutional water of kaolinite takes place between 400°C and 600°C. (*b*) It seems very probable that the dissociation of kaolinite into aluminium silicate and free silica commences at 650°C. (*c*) The internal change takes place between 900°C and 1000°C, it is probably a polymerization of the dissociated aluminium silicate. (*d*) Between 1200°C and 1300°C, we have also another internal change, which may be taken as the result of recombination of free silica and aluminium silicate formerly dissociated at lower temp. (6) Stones may be classified into 4 kinds:—(*a*) Unfused quartz grains coming from pot material. (*b*) Unfused quartz grains coming from glass batch. (*c*) Clay subs. coming from pot mat. (*d*) Insol. foreign mineral coming from pot mat. as well as glass batch. (7) Some precautions for elimination of the stone in the glass, and the cause of the formation of string have been discussed. O. P. R. O.

Graphical representation of rock analyses. J. Stiny. *Centr. Mineral. Geol.*, **1923**, 392–3.—Results are plotted on cross-section paper. Ordinates are %, abscissas SiO_2,-Al_2O_3, K_2O, etc., spaced at equal intervals. Plotting starts with SiO_2. The % of each of the remaining oxides is added to the sum of all the preceding ones and the total plotted. By joining the points so obtained, a line results which is characteristic for each rock family. J. E. G. (*C. A.*)

Fusibility of the ternary system: sodium fluoride, calcium fluoride, aluminium fluoride. P. P. Fedotieff and W. P. Iljinsky. *Z. anorg. allgem. Chem.*, **129**, 93–107 (1923).—The results of the study are given in the accompanying diagram. The black portions denote the unrealizable regions. The invariant points occur at 780, 705 and 675°.



J. A. A. (*C. A.*)

The electrical conductivity of solid and fused silicates. C. Doelter. *Rec. trav. chim.*, **42**, 729–32(1923).—A few silicates conduct at room temp. but at 1000° nearly all silicates become conductors. Results on the condy. and polarization of fused silicates are described. The detns. of polarization, especially, showed that even in the solid state electrolytic condy. is present in the silicates examd. In the fused state it is often large. From this D. concludes that ions are present even in the solid silicates but that they are firmly bound in the space lattice and for this reason the condy. does not appear until the ionic mobility is increased by raising the temp. D. has not detd. whether the condy. varies in different directions through the crystal. The existence of ions in crystals does not contradict the recent views on crystal structure. E. J. W. (*C. A.*)

Experiments on the expansion of ceramic mixtures. G. Capsa. *Bul. soc. chim. România*, **5**, 5–11(1923).—Emphasis is laid on the protracted expts. necessary to det. the influence of different ingredients and conditions during burning on the coeff. of expansion of faïence. C. C. D. (*C. A.*)

General

Ceramic industry in Czecho-Slovakia. RUDOLF BARTA. *Rev. Mat. Constr. Trav. Pub.*, **170**, 209–10B(1923).—I. *Raw Materials.* Percentage chem. analyses of some important raw materials and their fusion points are given.

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	KNaO	H_2O	Seger cone
Kaolin, Zettlitz (Sedlice)	45.92	38.17	0.50	0.15	0.11	1.10	13.95	(35)
Clay, Vilstajn	46.35	33.77	1.11	..	...	0.33	13.44	35
Clay, Mecholupy	46.42	36.67	0.56	..	...	..	16.68	35
Clay, Lisany	46.05	38.19	1.29	..	...	0.63	13.80	35
Clay, Blansko	50.03	35.29	1.57	0.42	0.49	0.50	12.05	34
Schistose clay, Rakonitz	52.50	45.22	0.81	..	...	0.50	0.78	36
Schistose clay, Janusov	43.38	42.07	0.80	0.18	0.20	0.21	14.25	37
Quartzite, Bohemian	97.79	1.41	0.13	0.11	0.19	0.39	0.25	..
Magnesite (Old Austrian)	3.03	7.12		2.25	87.60	..	...	..
Feldspar, Meclov	63.78	21.41	0.15	0.12	0.07	13.70	0.29	..

The Zettlitz kaolin contains 0.05% TiO_2. The alkali of the Meclov feldspar consists of 12.45% K_2O and 1.25% Na_2O. II. *Ceramic Products*, consist of porcelain, refractories, wall tile, paving blocks, stoneware pipe, brick, building tile, Portland cement and lime. III. *Ceramic Instruction and Technology.* Ceramics is taught in two polytechnic schools, at Prague and Brno, and in 4 indus. schools, at Bechyne, Plzen, Teplice and Znojmo. Among the scientific organizations are the Institute for silicate industries, the Institute for glass and ceramics. Standardization work is carried on by the Association for testing and exploiting of technical products. The "Société céramique tchéco-slovaque" has been lately founded at Prague and will publish its proceedings. L. N.

The unity of English weights. SAMUEL RUSSELL. *Science*, **58** (1509), 442(1923).—The author defines the English pound of which there is but one, weighing 7000 grains. He points out that the Troy pound no longer exists. The Troy ounce, however, is in common use. There is some confusion in Amer. in the use of the fluid ounce; we ought to adopt the Brit. system in which a fluid ounce is the volume of $^1/_{16}$ pound of water. The author recommends that the Brit. fluid ounce shall be our "standard ounce" and that it be decimalized. The use of the so-called long ton ought also to be abolished by law. C. J. H.

Combustion phenomena. E. KIEFT. *Combustion*, **9** [5], 390(1923).—The ht. value of a fuel is a function of its commercial value, not necessarily proportional to B.t.u., and depends also on compn., purpose and place of use. The phys.-chem. considerations of ht. transfer, combustion, and luminosity are discussed and illusd. C. R.

The making of earthenware, up to and including the first firing of the clayware. E. SHENTON. *Pottery Gaz.*, **48**, 1789–99(1923).—Address deals with origin of clays, methods of grinding, blunging, compounding of body, throwing, turning, handling, jiggering, casting, finishing, mold making, biscuit placing and firing as in English potteries. J. W. H.

No standard specifications for feldspar among producers and consumers. "CONSULTATION." *Eng. Mining Jour.-Press*, **114**, 1077(1922).—"Producers and consumers may have agreements that serve in lieu of standard requirements but they are a matter of individual negotiation rather than universal trade recognition ....." S. L. G.

Industrial analysis. ANON. *Eng. Mining Jour.-Press*, **113**, 81–97(1922).—Discusses production and markets for manganese, chromite, nickel, tungsten, molybdenum,

vanadium, uranium, radium, arsenic, barytes, bauxite and aluminum, borax, fluorspar, graphite, magnesite, talc and mica. S. L. G.

The non-metallic minerals. WARREN M. FOOTE. *Eng. Mining Jour.-Press*, **113**, 242–6(1922).—Review 1921 production of pumice, asbestos, graphite, limestone, pyrite, talc, clay, silica, bauxite, fluorspar, magnesite, chalk, sulfur, emery, gypsum, barytes, borax, phosphate rock and mica. S. L. G.

Future of non-metallic minerals. R. B. LADOO. *Eng. Mining Jour.-Press*, **113**, 146–7(1922).—Brief analysis of conditions and tendencies in mining, milling, etc. S. L. G.

Status of pulverized fuel. L. W. W. MORROW. *Elec. World*, **82**, 525–32(1923).—Advantages of the use of pulverized fuel in central stations include decreased losses and greater flexibility in operation. However, it cannot be assumed that its use is advantageous in all cases. Several installations are discussed and illus. Concrete bins allow longer storage than steel. For best results, 65% of the coal should pass 200-mesh, and it should contain less than 5% moisture. Below this figure, driers are unnecessary but if used tend to prevent clogging of the conveyors and consumption of more power in handling. W. H. B. (*C. A.*)

BOOK REVIEW

The Chemistry and Physics of Clays and Other Ceramic Materials. By A. B SEARLE. 1924. 695 pages. Ernest Benn, Ltd., Publishers, 8 Bouverie St., E. C. 4, London, England. Price, 55 shillings, net.

A clear and concise text covering the physical and chemical laws controlling the behavior of clays and all other ceramic and related materials. Also an excellent collection of data on the physical and chemical properties of the materials employed in ceramic manufacture and of other minerals and materials for which the ceramist would have an interest.

The data is presented in table form in nearly all cases and represents a very thorough search of scientific literature presented in a convenient form for use in the factory or laboratory.

The title of the volume fails to indicate that it contains a very large amount of data on the physical and chemical properties of burned ceramic products. This data is among the most valuable of the book's contents.

The book has the further advantages of an excellent table of contents and index which will commend it to many as a reference volume.

The material presented is in chapter form and may be briefly described as follows:

1. Physical Structure.—A brief treatise on crystalline and amorphous solids, pastes, slips, colloids and states of aggregation encountered in ceramic materials. Also mode of occurrence of ceramic materials and methods of reduction.

2. Properties Depending on Structure.—Shape and proportioning of grain size and influence on the product; methods of test, and influence and control of homogeneity, porosity and texture in the product.

3. Color, Hardness and Minor Physical Properties.—Natural and artificial sources of color in clays and the causes of discoloration; hardness, and its determination; effect of temperature on hardness of the product.

4. Strength and Allied Properties.—Forms of strength and factors affecting strength in raw and burned clays and bodies with data and test methods.

5. Specific Gravity and Density.—Explanation of the factors affecting these properties in ceramic bodies with test data.

6. Changes in Physical State Effected by Water.—General discussion of clay-water mixtures and their properties, including colloidal phenomena and the causes and measurement of plasticity.

7. Changes in Physical State Following the Removal of Water.—A brief presentation of the theory of drying of clays.

8. Chemical Constitution of Ceramic Materials.—The elements, laws of chemical combination and multiple proportions, atomic and molecular weights, valency, modes of expression, constitution of ceramic materials.

9. The Chemical Components of Ceramic Materials and Products.—Sampling, interpretation of analysis, impurities in clays and effect of composition on utility, general description of types of clay and types of ceramic ware with chemicals and percentage compositions, the Seger cones 022 to 42, various methods of expressing refractoriness, the chemical formulas of engobes and glazes of all types with methods of control and adjustment, and chemical compositions of all the important refractories.

10. The Mineralogical Composition of Ceramic Materials Including the Clays and Related and Associated Minerals.

11. Physical.—Chemical Reactions between Ceramic Materials.—The nature and type of chemical reactions and the influencing factors with explanation of equilibrium diagrams and description of physico-chemical processes.

12. Heat and Temperature.—Their measurements, thermal capacity, heat transmission, and heat and temperature measuring apparatus.

13. The Effect of Heat on Ceramic Materials.—During drying and burning, with finishing temperatures of different types of ceramic ware, the properties of the burned products, and a table of melting points of ceramic materials.

14. Electrical and Magnetic Properties of Ceramic Materials.—Data on electrical conductivity and specific resistance and the effect of composition on the electrical and magnetic properties of ceramic bodies.

15. Optical Properties of Ceramic Materials.—Description and data regarding refractive indices, birefringence and other optical properties of ceramic materials and manufactured ceramic wares.

ARTHUR S. WATTS

CERAMIC ABSTRACTS

Compiled by the

AMERICAN CERAMIC SOCIETY

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[1] The abbreviation (*C. A.*) at the end of an abstract indicates that the abstract was secured from the Editor of *Chemical Abstracts* by coöperative agreement.

Abrasives

Abrasives. Statistics, 1919-1921. ANON. *Imperial Min. Res. Bur., Min. Ind. Brit. Empire and Foreign Countries* (1924).—This report gives: world's production, summary of exports and imports of abrasives, details of imports and exports of the United Kingdom, Union of South Africa, Canada, Hong Kong, Australia, New Zealand, France, Germany, Greece, Switzerland, and the United States, concluding with a bibliography. O. P. R. O.

The marundites and allied corundum-bearing rocks in the Leysdorp district of the eastern Transvaal. A. L. HALL. *Trans. Geol. Soc. S. Africa*, **25**, 43–67(1923).—Marundites are rocks consisting essentially of margarite and corundum (whence the name) forming small vertical intrusives up to a few yards thick in pyroxenite, peridotite, and serpentine. Marundite may pass into plumasite (andesine-corundum-anorthosite) within the same rock body. Abnormal marundites are characterized by cyanite, Cr-mica, and a granular ruby-colored mica; but this type is known *in situ* at but one locality. The marundites are regarded as having been derived from quartz-feldspar pegmatites intrusive in magnesian rocks through the gradual removal of SiO_2 leading ultimately to a magma supersatd. with Al_2O_3, which sepd. out as corundum. The relative amt. of SiO_2 removed dets. whether plumastite or marundite is formed, and this is believed due to pneumatolytic conditions. These changes may occur *in situ* or prior to intrusion. The abnormal cyanite type probably arose under similar genetic conditions, perhaps prior to intrusion, and disturbed by the assimilation of accidental xenoliths. Analyses are given of margarite, marundites and plumasites. Cf. *Ceram. Abs.*, **1** [12], 317(1922). S. G. G. (*C. A.*)

PATENTS

Sand-paper, emery cloth, etc. MINNESOTA MINING AND MANUFACTURING CO. Brit. 194,274, Feb. 6, 1923. Waterproof sand-paper, emery cloth, or like material, comprises a base upon which the abrasive powder is secured by a non-hygroscopic cement or binder. The binder is in the form of a varnish prepd. from linseed oil or china wood oil and a gum, *e. g.*, kauri, copal, or dammar, and to which a drying agent, *e. g.*, Mn borate, is added. To accelerate the drying, and to improve the adhesive properties of the binder, electrolytic process white lead, known as "Dowdy white," is added; a paste drier, *e. g.*, $Pb(OAc)_2$ and resinate of Mn also may be employed. When a more fluid binder is required, a japan drier is used, *e. g.*, "schrack japan." In prepg. the *varnish*, the oil is boiled until it nearly reaches a solid state, and the varnish may comprise 3 parts of gum dammar with two parts of linseed oil. Castor oil may be incorporated with the varnish when the drying action is required to be retarded. After completion of the abrasive sheet, the base may be thinned down to give greater flexibility. The binder is applied under pressure. (*C. A.*)

Homogeneous crystalline products. H. A. RICHMOND and R. MACDONALD, JR. Can. 234,502, Sept. 25, 1923. A refractory, insulating and abrasive product characterized by great hardness, solidity, resistance to fracture and fine crystn. is composed of oxides of B, Al, Si, Fe and Ti fused together. (*C. A.*)

Art

Decorative painting on glass. MAURICE DE KEGHEL. *Rev. prod. chim.*, **26**, 645–8, 721–4, 759–60(1923).—A general discussion of the glasses, colors and especially of the vehicles suitable for painting on glass. A. P.-C. (*C. A.*)

Cement, Lime and Plaster

A new rapid hardening slag cement. R. M. *Rev. Mat. Constr. Trav. Pub.*, **172**, 1–4(1924).—A slag cement "Louve" having rapid hardening properties has been per-

fected by Pierre Prévost in France. Chem. analysis in wt. %: SiO_2 (uncombined) 1.2, SiO_2 (combined) 24.2, Al_2O_3 13.8, Fe_2O_3 1.6, CaO 46.3, MgO 2.4, SO_3 0.9, undetd. 9.6. The "hydraulic index" is 0.83; fineness of grinding, residue on 80-mesh screen (900 mesh per sq. cm.) 1%, residue on 180-mesh screen (4900 mesh per sq. cm.) 10%; apparent d. 0.880. The cement sets slowly, beginning 5 hours after tempering, and ending 8 and 15 hours later. The following are results of tests made for comparison between the "Louve" cement and the prevailing cements acceptable according to the specifications of the city of Paris.

TENSILE STRENGTH (KGS. PER SQ. CM.)

	24 h.	2 d.	7 d.	28 d.	3 m.	6 m.
Neat Cement						
"Louve" cement	17	24	29.7	32	36.5	40
Av. slag cement	...	7	20	26	28	30
Dry Mortar 1:3						
"Louve" cement	13	18.6	27.5	31.3	34.5	35
Av. slag cement	..	6	16	25	29	32

CRUSHING STRENGTH (KGS. PER SQ. CM.)

(1) Compn. 150 kgs. cement, 1 cu. m. gravel (20–40 mm.), 1/2 cu. m. sand

	18 h.	24 h.	48 h.	7 d.
"Louve" cement	3	5.2	18.5	27.5
Av. slag cement	..	2.7	4.2	21.9
Av. Portland cement	..	...	9.0	21

(2) Compn. 350 kgs. cement, 1 cu. m. gravel (5–20 mm.), 1/2 cu. m. sand

	18 h.	24 h.	48 h.	7 d.
"Louve" cement	7.9	9.7	18.8	38
Av. slag cement	3.2	4.2	6.2	25

By the use of a rapid hardening cement road-work is accessible to traffic in a short period of time. L. N.

Magnesium oxy-chlorides, their properties and uses in the construction field. M. Y. SEATON. *Tr. Am. Inst. Chem. Eng.*, **14,** 305–19(1922).—Magnesium oxychlorides, discovered by Sorel in 1867, have become an important structural binding material for compn. floors, wall stuccos, special molds for castings, etc. These bodies are made by treating with a dil. soln. of $MgCl_2$, a mixt. of MgO and an aggregate composed of fine sand, ground silica or marble, and a fibrous mat. such as asbestos or wood fiber. When applied to walls or floors they dry quickly to light and strong bodies which are sanitary, dustless and resistant to wear. The $MgCl_2$ comes chiefly from the salt brines of Michigan. The magnesium oxide used is made by calcining magnesite, obtained from the California and Washington deposits. Calcining in rotary kilns, with temp. carefully controlled at around 1100°C is the best practice. The plastic calcined oxide is ground to give 85% through 200-mesh. Increased demand in the future may be satisfied by plastic MgO made from dolomite. The sand used should be clean, and finer than concrete sand. The prepn. of the mixes is rather complicated and demands careful control so that it is not ordinarily practicable to prep. them at the point of use. The bodies will withstand water provided there is proper drainage, with no stagnant water in contact with them for long periods. Cf. *Ceram. Abs.*, **2** [7], 147(1923). B. M. L.

Gypsum. F. A. WILDER. *Mineral Ind.*, **31,** 354–60(1922).—The output of gypsum products and their value in 1922 was the greatest in history. The use of gypsum for land plaster, partitions, roofs, floors and plaster board is increasing. Many new

groups and trade affiliations appeared during the year. The use of rotary calciners of the Port. cement type was an outstanding feature. Ball mill grinding is becoming more common in connection with rotary kilns. In the Emley process, plaster of Paris is ground in ball mills, thereby driving out the chem. water. Recombining in the mill makes hard wall plaster denser and more plastic. Ready cut steel frame houses covered inside and outside with plaster board, and the floors and roofs made of gypsum are being erected in Canada. Outside bearing wall in another type of construction are being made of gypsum tile. Cf. *Ceram. Abs.*, **1** [6], 160(1922); *ibid.*, **1** [3], 91(1922). T. N. McV.

The energy of crystallization of burned gypsum. M. von Glasenapp. *Z. anorg. allgem. Chem.*, **130,** 246–52(1923).—The setting of gypsum is due to recrystallization as the dihydrate, following soln. of the hemihydrate. The resulting change in structure is illustrated by photomicrographs of the original and regenerated gypsum; the latter is composed of much finer crystals, is harder and more porous. Setting in water vapor only produces similar effects, with even finer crystals. (Cf. *Ceram. Abs.*, **2** [11], 239 (1923). B. H. C. (*C. A.*)

The scientific investigation of cement. Richard Grün. *Beton u. Eisen,* **22,** 281–3(1923).—An historical review and illustrated description of the new German institute for cement research. C. C. D. (*C. A.*)

Fused cement. A. Troche. *Beton u. Eisen,* **22,** 271–6(1923).—The properties of the recently developed high temp. cement (elec. cement, ciment fondu, etc.) are described, with extensive data (cf. *C. A.*, **15,** 583; **16,** 1845; 3374; **17,** 195, 619, 3739, 3409). C. C. D. (*C. A.*)

Bibliography of magnesian cements. G. H. West, R. L. Sebastian and W. A. Darrow. Bur. of Mines, *Repts. of Investigations,* No. **2534,** 17 pp.(1923).—211 titles. E. J. C. (*C. A.*)

Fused cement, electric cement, or aluminous cement. Ch. Bertin. *Bull. soc. ind. Rouen,* **51,** 339–43(1923).—Brief description of fused cement (invented by Bied) and of its merits, the chief of which are rapid setting and hardening (forms can be safely removed after 12 hrs.), high tensile and compressive strengths, and resistance to the action of sea water and sulfates. A. P.-C. (*C. A.*)

Lime in 1922. G. F. Loughlin and A. T. Coons. U. S. Geol. Survey, *Mineral Resources of U. S., 1922,* Pt. II, 195–206(preprint No. 23, publ. Dec. 1, 1923). E. J. C. (*C. A.*)

Gypsum in 1922. K. W. Cottrell. U. S. Geol. Survey, *Mineral Resources of U. S., 1922,* Pt. II, 133–9(preprint No. 16, publ. Oct. 18, 1923). E. J. C. (*C. A.*)

Enamel

PATENTS

Red cupriferous pigment for iron enamel. R. T. Hansen. Danish 30,646, Nov. 13, 1922. A mixt. of $CuSO_4$ soln., tin-putty and gum arabic with a diminutive addn. of $AuCl_3$ or cinnabar. (*C. A.*)

Operating muffle furnaces. F. G. Roberts. U. S. 1,472,401, Oct. 30. Muffles such as those used in firing enamel ware are kept continuously up to working temp. by simultaneously heating both the interior and exterior of the muffle. (*C. A.*)

Glass

The estimation of selenium in glass. A. Cousen. *Jour. Soc. Glass Tech.*, **7** [28], 303(1923).—A modification of Frankel's process. J. G. P.

The production of colorless glass in tank furnaces with special reference to the use of selenium. II. A. Cousen and W. E. S. Turner. *Jour. Soc. Glass Tech.*, **7**

[28], 309(1923); for Part I see *Ceram. Abs.*, **1** [5], 94(1923).—A very large number of small scale meltings were made in further elucidation of the behavior of selenium and sodium selenite during the decolorizing of glasses prepd. either from batches contg. soda only, or with small additions of salt cake, sodium nitrate, borax, or arsenious oxide. With batches contg. soda ash only, $^1/_2$ oz. of selenium per 1000 lb. of sand is more than sufficient to decolorize glass which contains only .04 to .06% of iron oxide, the glass becoming yellow as a result of the selenium excess. The presence of sodium nitrate does not prevent the liberation of selenium in glasses prepd. from batches contg. this salt, and they are colored much more intensely yellow or brown than soda ash glasses under corresponding conditions. The development of a yellow or brown color in glasses contg. selenium or sodium selenite is dependent on the time of heating as well as on the amount of selenium present. With glasses prepd. from soda ash batches or containing sodium nitrate, the yellow color deepens to brown when the glass is maintained for a period of hours at temps. between 1380°C and 1300°C. In batches containing salt cake, however, the color changes from yellow or pink to green, owing to the very small amt. of selenium retained in these batches and to the natural increase of iron oxide content as the glass stands in contact with the fire clay. A small amt. of borax equivalent to the yield of 1% of B_2O_3 in the glass was found to be without effect either on the amt. of selenium retained or upon the color of the glass as compared with pure soda ash batches only. Arsenious oxide in the propn. of 1.5 parts to 1000 of sand prevented the yellowish brown color due to selenium, even when an excessive amt. of the latter was added, and even when the glass was maintained for a considerable period at 1380–1300°C. Arsenious oxide is the only substance so far discovered which makes easy the decolorizing of selenium-contg. glasses and gives stability to the conditions. Analysis of the glasses for selenium showed that the greater part is lost by volatilization, a commercial glass only retaining 23% of that added. Batches which contain sodium nitrate being more readily fusible, retain considerably more selenium than those which produce glasses more slowly. The amt. of selenium actually needed for the operation of decolorizing appears to be exceedingly small. From indications so far obtained, it would appear that the selenium added to a batch does not become oxidized to selenite, but remains as selenium, its color only being developed slowly as the result of continued htg. J. G. P.

The refractive index changes in optical glasses occasioned by chilling and tempering. F. Twyman and F. Simeon. *Jour. Soc. Glass Tech.*, **7** [28], 262(1923).—A discussion. J. G. P.

Opaque and colored glasses and ceramic glazes of the same nature. Albert Granger. *Jour. Soc. Glass Tech.*, **7** [28], 291(1923).—A discussion in which the author demonstrates that the old purely chem. conceptions which have been applied to glass and to glazes are totally insufficient. One must accept the idea of a soln. in many of those cases wherein one formerly allowed the intervention of a compd., the actual existence of which was doubtful from the observed facts. J. G. P.

Pyrex glass as a material for chemical plant construction. A. E. Marshall. *Trans. Amer. Inst. Chem. Eng.*, **14**, 329–43(1922).—An outline of the development of Pyrex glass for large-scale plant equipment is included. The cleanliness, ease of inspection and observation, and resistivity to corrosion of glass equipment gives it many advantages wherever it is possible to use it. Pyrex has a very low expansion coeff., and a softening point of about 800°C. Denitrating towers, large evapg. dishes and retorts, tubing, high-tension insulators, etc., are among the articles made successfully from Pyrex glass. B. M. L.

Glass rings. A new filling material for towers. F. C. Zeisberg. *Trans. Amer. Inst. Chem. Eng.*, **14**, 321–7(1922).—Hollow cylinders or rings have been shown to be

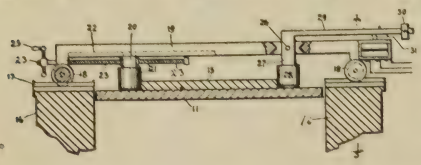
very efficient for packing towers. They are now being made of stoneware but the smallest sizes practicable using such material are bigger than desirable for many uses. Small metal rings now made present such a large surface that any chemical reaction with the liquids and gases present results in rather severe corrosion of the metal. The DuPont Co. has developed glass rings for packing to the point of fairly cheap quantity production. These can be made as small as necessary, give good service for certain purposes and are easily cleaned. Properties and tentative prices for the sizes made are given. B. M. L.

Heat economy in the glass industry. ANON. *Arch. Wärmewirtschaft,* **4,** 159–60 (1923).—A description of the diagnosis of typical cases of fuel squandering in glass works. The causes were: air leaks into regenerative chambers; excessive steam in the producers; too low a fuel bed in the producers; leaky reversing valves; too little draft in the producers; too infrequent clinkering. E. W. T. (*C. A.*)

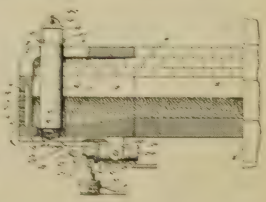
Simple and accurate method for determining surface tension and density of molten glass. EDW. W. WASHBURN. *Proc. Am. Phys. Soc.,* **1922;** *Phys. Rev.,* **20,** 94–5 (1922).—The surface tension of molten glass is detd. from the positions of a Pt cylinder suspended by a sensitive spring free in air and after raising a small pot of molten glass so that the surface of the glass makes contact with the cylinder. The cylinder is standardized before and after each detn. by similar measurements with liquids of known surface tension. The d. is detd. with the same app. but with a Pt sphere substituted in place of the Pt cylinder. The surface tension of the soda-lime-silica glasses between 1200° and 1450° is of the order of magnitude of 150 dynes per cm. D. MACR. (*C. A.*)

PATENTS

Glass machinery. CLARENCE W. AVERY and WENZEL G. VESEY. U. S. 1,482,106, Jan. 29, 1924. In a glass width regulator for glass strip forming machinery having a moving platform with strip forming members associated therewith, a frame adapted to be moved transversely of the line of movement of the platform by a strip formed on the platform, an adjustable stop on said frame and a movable stop on said frame whereby the strip passing between the stops may cause the frame to vary its position relative to the platform, the adjustable stop may determine the width of the strip formed on the platform, and the movable stop may be actuated by variations in the width of the strip to vary the speed of the platform.



Glass-delivering apparatus. JOHN W. CARNAHAN. U. S. 1,481,688, Jan. 22, 1924. The combination with a glass fur. snout having a discharge opening, of a knife cutting off the glass discharge through the opening, and means for shifting the knife transversely across the opening and then lowering the knife away from the discharge opening and returning it to its initial position. The combination with a glass fur. snout having a discharge opening in its bottom, of an annular bushing of refrac. mat. disposed in said discharge opening and through which the glass passes, a metallic plate in the bottom of the snout having an outwardly and downwardly flared opening larger than the opening of the bushing, means for cooling said plate, a vertically shiftable plug disposed within the snout and having its lower end reduced to form a portion fitting the lower end of the bushing, a shoulder above said bushing adapted, when the plug is lowered, to rest on the bushing and cut off the flow of glass therethrough, the lower end



of the plug having the form of an inverted cone, and a knife disposed against the metallic plate and reciprocable across the axis of the opening therethrough and below the conical lower end of the plug when the latter is lowered to thereby cut off the thread of glass depending from the extremity of the plug when the plug is lowered.

Ornamenting glass, etc. G. L. HUYSMANS. Brit. 199,802, March 28, 1922. Raised designs or inscriptions are produced on glass, pottery, etc., by the application of a plastic compn. consisting of finely powd. metals, such as Cu, Al and Mg, mixed with an emulsion of $CaCO_3$, a thick soln. of mucilage such as Senegal gum, copal, $Al_2(SO_4)_3$ and coal tar or drying oil. The compn. hardens without high temp. baking. A suitable method of applying the compn. is by extrusion app. The leads of stained glass may be imitated by this process. (*C. A.*)

Bottles; silvering. H. FERGUSON. Brit. 200,448, Jan. 25, 1923. A bottle is made in the shape of a revolver or pistol and the inner surface is coated with Ag, etc., by the "formaldehyde" or other known process. The muzzle forms the neck of the bottle and may receive a cork or stopper. In the method of coating described, 3 aq. solns. are poured into the bottle in turn, the first consisting of cryst. $AgNO_3$ and NH_3, the second of HCHO, and the third of 1 part by vol. of the first soln. with 2 parts of the second. The coating is then washed with distd. H_2O. (*C. A.*)

Glass manufacture. CORNING GLASS WORKS. Brit. 194,888, Feb. 7, 1922. A decolorizer for use with borosilicate glasses consists of Nd_2O_3. About 0.5 to 1% of the decolorizer is added to the batch to neutralize the yellow green tint of the glass due to the presence of Fe. The product commercially known as "didymium oxide," which is a mixt. of Nd_2O_3 and La oxide, is used. The amt. of Nd_2O_3 may be increased to 5% if it is desired to produce a pink color in the glass. (*C. A.*)

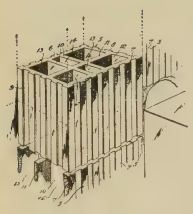
Glass manufacture. CORNING GLASS WORKS. Brit. 195,495, Feb. 7, 1922. A process of making translucent or opaque glass consists in melting a batch contg. boric oxide, a relatively high % of SiO_2, and a chloride, bromide, or sulfate. Preferably, the boric oxide content of the batch is not less than the alkali content, and the SiO_2 is over 70% of the ingredients other than the chloride, bromide, or sulfate. In practice, 1 to 5 parts of a chloride, bromide, or sulfate, preferably of an alkali metal, are added to 100 parts of a suitable foundation glass or its batch. The compns. of a no. of suitable foundation glasses are given in the specification. (*C. A.*)

Heavy Clay Products

British test road. ANON. *Roads and Road Construction* (London), **1**, 395(1924).—An appeal has been made for a test road in England such as has been constructed in various places in America. The proposal is to make a mile of road using 8 types of foundation and 8 types of surface finish and it will be tested to destruction by the continuous running of loaded motor lorries over it. The results would produce facts for the highway engineer to embody into his specif. which would be of untold value and mean great economy in construction work, in as far as it would show how to avoid mistakes. O. P. R. O.

PATENT

Hollow building tile. EDWIN J. BEINECKE. U. S. 1,481,249, Jan. 22, 1924. A wall structure, comprising superimposed courses of cellular tiles having front, back and side outer walls, inner walls extending from front to back, and from side to side, forming front and back passages in said tiles, the front passages being of less area than the back passages, the opposite ends of the tile of one course lying in substantially parallel planes, the upper ends of the tile of an adjacent course having a front reduced portion, the front and back outer walls of the several courses of tile being arranged in alignment with each



other, the inner front and back connecting walls of one course of tile being arranged in staggered relation to the corresponding walls of a vertically adjacent course, and a facing composed of courses of stringer bricks and an intermediate course of header bricks, the inner ends of the header bricks overlapping the reduced portion of the upper end of one course of tile and being bonded therewith on the upper end of the front wall of said tile and on an innerside connecting wall parallel therewith.

Porous ceramic material. E. C. BAYER. Danish 29,386, Feb. 20, 1922. Ferruginous plastic clay is heated above its sintering point, pulverized, mixed with moist plastic clay, molded and burned. (*C. A.*)

Refractories

Alumina and bauxite. R. J. ANDERSON. *Mineral Ind.*, **31,** 8–37(1922).—An article on statistics and changes in technology and uses of alumina for 1922. Diaspore and high alumina clays have nearly taken the place of bauxite for refractories. Large amts. of these clays are being mined in Missouri. Low grade bauxite is used in France for alumina cements. The Everhart process for washing bauxite clays in the presence of small amts. of peptizers has possibilities. Richmond and McDonald obtain a very pure abrasive by melting bauxite in an elec. fur. and reducing impurities with carbon. Quantity production of sillimanite has been started. The use of ZrO_2—10% Al_2O_3 for steel furnaces has been examined. Several new methods for producing K and Al sulphates from feldspars and shales have been proposed. T. N. McV.

Graphite. B. L. MILLER. *Mineral Ind.*, **31,** 347–53(1922).—The graphite industry was almost stagnant in 1922. Wartime stocks have not been exhausted. Prices were lower than in 1922. A British patent contains new features. Natural graphite is purified from silica, alumina, pyrite and mica by intimate mixing with coal, charcoal or coke. The mixt. is elec. heated to approx. 2200°C. The coal unites with impurities which are volatilized and collected. Silica is used for filtering or polishing powder, the SO_3 for mfg. H_2SO_4 and metallic oxides for met. purposes. T. N. McV.

Magnesite. S. H. DOLBEAR. *Mineral Ind.*, **31,** 451–6(1922).—There was an increase of production of 32% in 1922. Imports were $3^1/_3$ times those of 1921. Practically all domestic production came from Calif. and was used in the chem. industries and for mfg. of magnesite cement. Most of the imported mat. came from the Austrian mines. This article gives tables of imports and domestic production. T. N. McV.

Electric furnace phenomena. E. T. MOORE. *Assoc. of Iron and Steel Elec. Engrs.*, **5,** 529–82(1923).—M., in a lengthy paper, discusses the work of the Electric Furnace Committee of the Assoc. of Iron and Steel Elec. Engrs. and presents report of this committee for 1923. Research has been designed to include work along the following lines: (1) a thorough study of the heat losses from elec. furs.; (2) presentation of operating data on fur. electrodes according to the electrode specifs. drawn up by the committee and presented in the 1920 report; (3) an investg. of the merits of dual voltages, and the deleterious effect on the metal, if any, of a relatively high voltage for melting; and (4) investg. of elec.-fur. phenomena. These lines of tests have not been completed with the exception of (3), and work is still in progress. The tests were carried out on a stand. 6-T. Heroult fur. at the works of the Holcomb Steel Co., Syracuse, N. Y., and alloy steels were melted. Much of the data presented are of no interest to ceramists, but certain of the main conclusions arrived at may be summarized as follows: (1) The amt. of unbalancing between phases in an individual fur. is considerable, as shown by oscillograms and graphic meter charts, and the max. difference noted is 340 kw. or 21% of the connected load. This is not of such magnitude as to affect operations. (2) The max.

current values reached during the melting period is 1.1 times normal. (3) Arcs in a fur. set up high frequency disturbances; these are of the order of 5,000 cycles. (4) The power factor was 90% for the melting period and 88% for the refining period, and 89% for the entire heat. (5) The burning out of the back wall in a furnace or the burning of the refractory anywhere within the fur. is a function of the power introduced into the fur. and the distance which the arcs are from such refracs. Burning out of refracs. can be regulated by proper spacing of the electrodes so as to increase the distance of the arcs from the refrac. walls. By closer concn. of the electrodes, the connected capacity can be increased, thus giving a faster melting fur. (6) The limiting capacity of elec. furs. (by which is meant the largest amt. of power that can be introduced into a fur.) varies with the actual size of the fur.; a 25-T. furnace with a connected capacity of 4,500 kva., on a 25-cycle circuit, is about as large as should be installed when melting is done and where only one set of electrodes is used. For hot metal work, a fur. of 40-T. capacity with a connected load of 3,300 kva. is very satisfactory using one set of electrodes of 24-in. diam. In 60-cycle circuits where melting is done, using only one set of electrodes, furs. beyond 15 T. are not recommended, but for hot-metal work a fur. of 40-T. capacity is satisfactory. By using more than one set of electrodes, it is possible to build a fur. of several hundred T. capacity. (7) There seems to be an impression that 60-cycle arcs have less cutting action on the refracs. than 25-cycle arcs, but this cannot be substantiated. (8) It has been claimed that higher temps. can be obtained in 60-cycle furs. than in 25-cycle furs., but this cannot be substantiated. The type and resistance of the current-carrying mat. determines this. (9) With a bath of steel liquid in the fur., the power cannot be safely interrupted for longer than three-quarters of an hr. R. J. A.

Graphites for brass melting crucibles. ANON. *Metal Industry* (New York), **22,** 59(1924).—Discussion of report from Bureau of Mines recommending American graphites. Based on interview with Jonathan Bartley. Gives compositions of alloys used and results of tests by R. T. Stull and L. E. Geyer, denoting that Alabama graphite bonded with American clays gave superior service. Sharp disagreement with this conclusion by two crucible manufacturers led to investigation of research work done by Bureau. Results were obtained only up to 13.1 heats per crucible when a crucible should give from 30–40 heats before being considered commercial. It was found that mats. were assembled in 1918 and crucibles were not ready till December of that year. After the Armistice no effort was made to hasten work and the last of the crucibles were not tested till fall of 1922. During at least part of the period from 1918–1922 good Ceylon or Madagascar graphite could not be obtained and the Alabama graphite was therefore tested against very low grades. Thus, the Bureau results are hardly conclusive and the use of American bond clays is more a matter of indiv. preference and local conditions. R. J. A.

Technical literature on refractories. P. L. M. *Rev. Mat. Constr. Trav. Pub.*, **164,** 93–4B; **165,** 116–8B; **166,** 137–9B; **167,** 152–5B; **168,** 177–9B; **169,** 196–7B; **170,** 215–8B; **171,** 237–9B(1923).—The subject matter and references have been taken mainly from English and American literature. In some cases the references only are given, in others the text and data are also quoted. The information is gathered under the following headings: (1) (*a*) Tests of refrac. (*b*) Slagging tests of refrac. (*c*) Usefulness of standard methods for detg. thermal cond. of refrac. materials. (*d*) Bibliography on thermal condy. of refractories. (2) (*a*) Reversible dilatation of refrac. (*b*) Alumina refrac. (*c*) Magnesite and dolomite refrac. (*d*) Zirconia refrac. (*e*) English (American) methods of testing refrac. products. These cover chem. analysis, porosity, shrinkage, compression strength, fusion tests, coeff. of expansion. (3) (*a*) Chrome refrac. (*b*) Burning life of refrac. (*c*) Amer. specif. standards for glass refrac. L. N.

Natural sillimanite as a glass refractory material. S. ENGLISH. *Jour. Soc. Glass Tech.*, **7** [28], 258(1923).—A discussion. J. G. P.

Graphite in Western Australia. WILSON. *Chem. Eng. & Min. Rev.*, **16**, 101 (1924).—A report on the Mattigallup deposit of graphite by Wilson, Ass't State Mining Engineer. The graphite occurs in flat, shallow, undulating beds of kaolin or clay, in seams varying from 6 to 24 in. wide, which do not appear to be continuous for any great distance. In the No. 1 shaft a bulge seems to have occurred, there being 8 ft. of lode showing. The surface rock consists of hard ironstone laterite in which graphite can be seen in places, and at the bottom of the deeper shafts the country rock, which consists of kaolin, seems to lose its bedded character and may possibly represent the weathered portion of a more or less basic rock. While of low grade and too small for work on a large scale, W. calls attention to the comparatively low grade mines being worked in Canada by dry concn., and by flotation units and electrostatic separators, and recommends some exptl. work on these lines. The Mines Department is now considering giving financial assistance in the development work under the mining development act. O. P. R. O.

The effect of salt coal upon refractory materials. L. M. WILSON. *Colliery Guardian*, **126**, 906–7(1923).—Expts. analogous to those of Clewes and Thompson (cf. *C. A.*, **16** 3821) on the effect of NaCl on SiO_2 are described in which the *effect of NH_4Cl on refrac. materials* was studied. The results show the superiority of high-grade SiO_2 over fire clay for the lining of coke ovens in its resistance to salty coal. The amt. of Al_2O_3 removed from fire clay increased with the temp. 900–10° was a *crit. temp.* below which very little Al_2O_3 was removed and above which a large amt. was removed. No crit. temp. was found for high SiO_2 brick. Fe is also removed by NH_4Cl from bricks at high temps. Comparative expts. with Pt and Si boats showed that free SiO_2 aids the removal of Al_2O_3 from fire clay exposed to NH_4Cl at high temps. Al_2O_3 reacted in some way with the SiO_2 below the m. p. of either, thus confirming the observation of Cobb (cf. *C. A.*, **4**, 1658) of the *interaction of solids at temps. below the m. p. of either.* C. C. D. (*C. A.*)

The silica-brick works of the Consett Iron Co. ANON. *Colliery Guardian*, **126**, 1163–4(1923).—An illustrated description of the Consett Iron Co. brickworks. The products contain approx. 30% tridymite and only a trace of unconverted quartz, insuring *absence of permanent or after-expansion.* Expansion is nearly complete at approx. 600°; none occurs at 1000–1400°; and above 1400° a slight contraction takes place. C. C. D. (*C. A.*)

PATENTS

Graphite crucible. RYUTARO KONISHI. Japan. 41,935, Mar. 8, 1922. The resistance to oxidation and to heat of a graphite crucible is increased by coating the outside first with a mixt. of 70 parts of carborundum, 30 parts of a special porcelain clay and 30 parts of H_2O, and then with a mixt. of 70 parts of a glaze (*e. g.*, made of 45 parts of feldspar, 18 parts of CaO, 10 parts of clay and 27 parts of SiO_2), 30 parts of carborundum and 100 parts of H_2O. (*C. A.*)

Refractory abrasive compositions. L. E. BOURDEAU. Brit. 200,903, April 19, 1922. A mixt. consisting chiefly of bauxite and basalt is fused with smaller proportions of ilmenite, cerite, C, and a flux such as Na fluosilicate. Substance such as emery, corundum, flint, and quartz may also be added. The product may be colored by the addn. of suitable oxides so as to indicate its degree of hardness. (*C. A.*)

Silica bricks. PEASE & PARTNERS, LTD. and J. WILSON. Brit. 193,999, Dec. 8, 1921. Small proportions of china clay and lime are added to Dinas stone, ganister, or other material used in making silica bricks. Preferred proportions are 96% of silica, $2^1/_2$% of china clay and $1^1/_2$% of lime. The china clay and lime are suspended in the water with which the powd. silica is rendered plastic. (*C. A.*)

Dolomite bricks. T. Hodson, J. Hodson, W. Hodson and T. A. Hodson. Brit. 193,576, Dec. 17, 1921. Refractory basic bricks, furnace linings, retorts, etc., are obtained by calcining dolomite, magnesite, or magnesian limestone, adding small quantities (about 15%) of igneous rocks, other than granites and syenites, and in some cases a little basic Fe ore, mixing with H_2O, molding, and firing at 2,000°. Suitable igneous rocks are the peridotites (including diorite and gabbro), the dolerites (including basalts), the serpentines, trachytes, andesites, tachylytes, eurites and rhyolites. If rocks of the last two classes are employed, or if the dolomite contains more than 1% of SiO_2 or 57% of $CaCO_3$, it is necessary to add 3% of basic iron ore, such as titanic iron ore, magnetite, hematite, or gothite. (*C. A.*)

Refractory article and method of making the same. William A. Harty. U. S. 1,473,853, Jan. 22, 1924. A refractory article containing fire clay and fused silica.

Terra Cotta

The unique development of modern chemical stoneware. P. C. Kingsbury. *Trans. Amer. Inst. Chem. Eng.*, **14,** 275–92(1922).—A very good gen. discussion of the industry is given, with illustrations of products. Process efficiency in much of chemical industry is dependent on varied stoneware shapes adapted to special uses. Most of these have been developed only in the past 20 years. Chemical stoneware is essentially a framework of more or less refractory particles held together by vitrifying clays. Fineness, density and refractoriness of bodies are varied, depending upon the use for the products. The bond clays used must vitrify at the kiln temp., and fuse only at a considerably higher temp., so there will be no softening of shapes in the kiln. It must have high plasticity and strength in the green state, to make possible the production of complicated shapes. Mixtures of various clays are used, which are washed and mixed, and before using are stored in blocks for two years in a satd. atmosphere, which increases the plasticity. Most shapes must be dried very slowly in a carefully controlled atmosphere to prevent deformation in bodies which have from 6–12% linear shrinkage. Burning is carried to about 1300°C, requiring up to 3 weeks in the largest kilns. Stoneware resists the action of all acids but hydrofluoric acid and strong, hot phosphoric acid. Caustic alkali solns. have slight action upon it when hot and concd. Filter presses, large rotary driers, exhaust fans, pumps, condensation coils, complete equipment for muriatic acid plants, etc., are among the newer products made from stoneware.

B. M. L.

Whiteware

Note books of Josiah Wedgwood. B. Moore and J. W. Mellor. *Trans. Ceram. Soc.* (Eng.), **22,** 275–82(1923).—For abstract see **2** [7], 142(1923). H. F. S.

The crazing of English earthenware. A. Heath. *Trans. Ceram. Soc.* (Eng.), **2,** 213–40(1923).—The common practice of the English earthenware manufacturer has been confined to the use of a certain type of body, which matures at a fairly low biscuit temp., and a glaze which, in general, gives good results at a still lower temp. If the body mats. are controlled by the use of definite chem. and phys. tests, little trouble is experienced, but if, through lack of control, any variation in the compn. of these mats. is ignored, the "balance" of the body with the glaze is upset, and trouble is encountered. The work contd. in this paper expresses the limit of variation in the compn. of a body in relation to crazing and peeling with a given glaze. H. F. S.

Porcelain. S. Schertel. *Mikrokosmos*, **16,** 214–5(1923).—A popular description is given of the use of feldspar, kaolin and quartz in the manuf. of porcelain. Photomicrographs are shown of feldspar and porcelain after heating to different temps. near the m. p. L. W. R. (*C. A.*)

Shock tester for porcelain insulators. W. Bucksath. *Elektrotechn. Z.*, **44**, 943–7, 975–80(1923). C. G. F. (*C. A.*)

Equipment and Apparatus

A new electric radiation furnace. A. Paolini. *Giorn. Chem. Ind. ed App.*, **5**, 539(1923).—This fur. is designed for operation from 1400–1500°C and is planned for burning of ceramic products. A resistor of graphite (99% C) is used and a refrac. withstanding 2000°C. Radiation channels are used coming into the fur. from the carbon resistor in cone shapes thus giving a greater radiating surface. Various types of terminals are shown and discussed. The furnace operates on 150 kw. A tunnel car type is used also. The furnace is possible for use in metallurgical practice, production of refractories, porcelains, by-product coke, calcination of dolomite, cements, sodium sulphide and sodium aluminate from bauxite. S. S. C.

Notes on the application of pyrometers to ceramic industries. C. E. Foster. *Trans. Ceram. Soc.*, **22**, 248–74.—The matter of elec. resistance of the circuit is of fundamental importance. It is necessary that the resistance of the circuit should remain approx. constant with changes in temp. in any part of the circuit, in order that, for any given temp. of the "hot junction," the current flowing in the circuit (and consequently the reading of the indicator) shall be approx. the same as when the instrument was calibrated. A large propn. of the total instrument resistance shall be of mat. which does not change appreciably with change in temp. It is not essential that the total resistance should be high, but only that the propn. of ballast resistance should be high. To make a base metal pyrometer of low total resistance and yet capable of accurate measurement, it is only necessary that the propn. of ballast resistance shall be large enough, and there is no essential need for a high total resistance. The cases where it is necessary to use rare metals in industrial work are only relatively few. Clockwork is the usual device employed for running the recorder mechanism, and there should be a large margin of power to allow the instrument to continue running under adverse conditions. The resistance thermometer, operating by the change in resistance of a coil of fine wire which is put in the place of the "hot junction" of the thermocouple, requires an outside source of current; it does not produce its own e. m. f. It depends upon the balancing of the varying resistance of this coil of wire, known as the "bulb," against other resistances in the instrument. The resistance thermometer should not be used industrially at temps. where distortion is likely to occur, and, therefore, it is not a type of much interest to the ceramic industry. Considerable progress has been made in the application of radiation pyrometers to high temp. measurement. In the case of a pyrometer which operates by the total range of ht. radiations, both short visible and long invisible wave-lengths, known as a "total radiation" instrument, the ht. radiated from the hot body under measurement is concentrated upon some device sensitive to heat, for instance, a very small thermocouple. The instrument then operates in the same manner as an inserted thermocouple. An optical pyrometer is one in which the visible brightness of the hot body is measured or extinguished. In the extinction type, the hot body is viewed through an absorbing medium, the thickness of which is increased until the observer considers that he can no longer see the hot body. Such an instrument requires to be used with the knowledge that the sensibility of the eye depends on the length of time it has been in the dark. The other type depends upon the matching of the brightness of the hot body against that of a source of light carried with the instrument. Here the personal element is much less, exposure of the eye to a bright light will only decrease the closeness of the match and will not alter the position on the temp. scale. One great advantage of the optical pyrometer is that it can be used at much greater working distances, and on much smaller hot bodies, than the total radiation type. H. F. S.

Modern electrical pyrometry. DAVID BROWNLIE. *Chem. Trade Jour.*, **73** [1892], 213–6(1923).—This is a general and not too technical description of the types of elec. pyrometers used, with several applications on boiler practice. The limits of the glass mercurial thermometer are indicated as between 900° and 1000°F for intermittent work, and below that for permanent work. Elec. pyrometry is divided into two classes, thermoelec. and elec. resistant pyrometry. The thermoelec. pyrometers are further classified as base metal and platinum-rhodium pyrometers. The base metal pyrometers are described and several alloys are mentioned as used for the "pointers" or thermoelements. The platinum-rhodium, or Le Chatelier couple, is described and a general theory of the development of current shown. Diagrams and some pictures of English pyrometers are shown, giving the method of indicating or recording the temp. as it affects the elec. current produced. The elec. resistance pyrometer is described and it is just shown for use at distances greater than permissible with the thermoelec. It is useful also at extremely low temperatures, but it is limited at the higher range. Two installations on boilers are described in detail and the advantage of recording instruments is shown. A brief mention is made of the elec. radiation pyrometer, which is a special application of the thermoelec. pyrometer. F. C. F.

PATENT

Electrical resistance. S. KATALAIN. Brit. 197,340, May 7, 1923. An elec. resistance mat. which does not fuse or oxidize at high temps. is composed of various ferro alloys, ferro silicon, ferro tungsten, ferro molybdenum, ferro titanium, ferro chromate, etc., mixed with fire clay, magnesite, etc. These are mixed, kneaded and heated to 1500–1600°. W. M. C.

Kilns, Furnaces, Fuels and Combustion

Some new forms of kilns. A. DUCKHAM. *Trans. Ceram. Soc.* (Eng.), **22,** 298–312 (1923).—A kiln of the continuous type, 16 chambers in all, is described. The chambers are arranged in two lines, with wickets on the outside only. There are 4 fire-holes and bags to each chamber, the arrangement of firing being that generally known as semi-gaseous. A. W. D. Central Bag Kiln is discussed. Its advantages are: even heating; bag forms no portion of the kiln proper, can be made of different mat., and can be easily renewed; proper combustion of the heating gases; the brickwork forming the kiln proper is never subjected to the direct action of the heating gases during combustion. The advantages of a tunnel kiln are: saving of labor, fuel, and heating and cooling of the materials. The disadvantages are: mechanical, the great length of the tunnel, the tendency of the htg. gases to rise, and so cause uneven burning. See also *Ceram. Abs.*, **2** [3], 45(1923). H. F. S.

PATENTS

Brick kiln. YASABURO SAITO. Japan. 42,989, June 30, 1922. This is a parallel ring kiln with two main flues between two burning channels instead of one as usual. Each main flue is connected with the opposite burning channel by small flues which pass under the other. It has a drying chamber on the main flues. Another drying tunnel is constructed around the kiln. Pipes are imbedded in the kiln body over the crown. Hot air produced in them by conduction is utilized in drying bricks by connecting the pipes with the drying chamber and tunnel. (*C. A.*)

Improvement in kiln for burning brick and similar wares. TOKUSABURO SATO. Japan. 42,666, May 20, 1922. The kiln is provided with fire-boxes, each of which has a drop-arch and a channel-shaped wall at its rear. The drop-arch directs the flame produced on the grate downward. The flame then strikes the inverted-channel wall, which is a kind of very low flash wall, situated much nearer to the grate than usual.

The construction keeps the furnace end hot and aids the complete combustion of gases. (*C. A.*)

Geology

The geology of the Bournemouth District. HENRY DEWEY. *Trans. Ceram. Soc.*, **22,** 293–7(1924).—The area dealt with extends from Wareham eastwards to Christchurch, and northward from the Isle of Purbeck to Wimborne. Attention is called to those formations which possess the greatest interest to the English Ceramic Society. H. F. S.

China clay statistics 1919-1921. ANON. *Imperial Mineral Res. Bureau, Min. Ind. Brit. Empire and Foreign Countries*(1924).—China clay statistics for 1919–1921. Introductory note gives different systems used by various countries for computing imports and exports; the annual av. rates of exchange; and states that the British statute ton, 2,240 lb. avdp. (the long ton) is used throughout the rept. The world's production of china clay is given; summary of exports; summary of imports; details of exports and imports for United Kingdom, Canada, India, Czechoslovakia, Denmark, France, Germany, Italy, Sweden, Switzerland and United States are given. The reports conclude with a brief statistical bibliography. O. P. R. O.

Fluorspar statistics, 1919-1921. ANON. *Imperial Mineral Res. Bur., Min. Ind. Brit. Empire and Foreign Countries*(1924).—Different systems used by various countries for computing imports and exports are given in an introductory note, also the average rates of exchange. The long ton (the British statute ton of 2,240 lb.) is used throughout the report. World's production of fluorspar is given; summary of exports and of imports; details of imports and exports for United Kingdom, Canada, Sweden, and the United States are given; also with a list of statistical publications. O. P. R. O.

Kaolin mining, Victoria. ANON. *Chem. Eng. and Mining Rev.* (Melbourne, Victoria), **16,** 100(1923).—Kaolin mining is being actively carried on at Egerton and Gordon. In a crosscut of a new shaft, the deposit of pipe clay is 6 ft. wide, and of very good quality. O. P. R. O.

PATENTS

Pottery. J. E. TAMS. Brit. 198,607, Sept. 16, 1922. A transparent body similar to china, feldspar, or Parian consists of powd. asbestos and powd. frit produced from powd. asbestos and soda fretted in the usual way and ground. China clay, feldspar, or stone may be added. (*C. A.*)

Pottery materials. W. GREEN. Brit. 198,817, March 18, 1922. A ceramic material is made by incorporating hard porcelain ingredients contg. potash, etc., with a sintered irreducible oxide such as pure alumina or zirconia of a high m. p. The compn. is fired at a high temp. to produce a hard tough product having a low elec. condy. and a low porosity. The compn. may consist of alumina, potash, feldspar, china clay, and ground flint. Cores which resist the action of liquid of gaseous Hg may be made from the compn. (*C. A.*)

Fluorite-chillagoe (Victoria). E. C. SAINT-SMITH. *Chem. Eng. and Mining Rev.* (Melbourne, Victoria), **16,** 94(1923).—S. estimates 9,000 T. of high-grade fluorite available at a mining cost of 10 s. per T. with probably a much greater tonnage available below water level. The estimate cost delivered at the port of Cairns is 43s. Analysis of an av. sample from one of the surface outcrops gave 96.74% of calcium fluoride, and 1.12% of calcium carbonate. O. P. R. O.

Preparation of amorphous silica, free from alkali. J. MICHAEL AND CO. Ger. 348,769 (Berlin), (*Oil & Color Trade Jour.*, **65,** 40(1924)).—Precipitated silica, washed

with water or acids, is treated with a metallic salt, especially of the alkaline earths, magnesium or aluminium and then washed again in the usual manner. O. P. R. O.

Note on Quartz from Kragerø, Norway. J. C. JØRGENSEN. *Tidsskrift for kemi og bergvesen,* **3,** 164(1923).—Pre-Cambrian quartzite forming thick benches and occurring in large deposits contains 98–99% SiO_2. The chief impurity is muscovite. The content of Fe is .14–.17%. The annual production from one quarry located on an island has reached 15,000 T. The quartz is used in the manuf. of ferrosilicon and to some extent in ceramics. O. A.

Silica in 1922. F. J. KATZ. U. S. Geol. Survey, *Mineral Resources of U. S., 1922,* Pt. II, 183–6(preprint No. 21, publ. Nov. 27, 1923). E. J. C. (*C. A.*)

Talc and soapstone in 1922. EDWARD SAMPSON. U. S. Geol. Survey, *Mineral Resources of U. S., 1922,* Pt. II, 81–6(preprint No. 13, publ. Oct. 11, 1923). E. J. C. (*C. A.*)

Clay in 1922. JEFFERSON MIDDLETON. U. S. Geol. Survey, *Mineral Resources of U. S., 1922,* Pt. II, 73–80(preprint No. 12, publ. Oct. 10, 1923).—For clay in 1921 see *Ceram. Abs.,* **2** [6], 139(1923). E. J. C. (*C. A.*)

Chemistry and Physics

Borax. A. T. WARD. *Mineral Ind.,* **31,** 80–83(1922).—Borax ($Na_2B_4O_7$) is produced by refining ulexite ($NaCaB_5O_9.8H_2O$) and by treating colemanite ($Ca_2B_6O_{11}.5H_2O$) with Na_2CO_3 and Na_2SO_4. Other crude borax minerals of commercial importance are sassolite (from Italy); pandermite (from Asia Minor) and tincal (from Tibet). Borax may be obtained from howlite ($4CaO.5B_2O_3.2SiO_2.5H_2O$). The Oregon borax mineral priceite ($5CaO.6B_2O_3.9H_2O$) is identical with pandermite. Most of boric acid is prepd. by chem. treatment of colemanite. Half of the borax produced in this country or 20,000 metric tons is used in the pottery and enamel industries. All borax produced is from the western part of the U. S. T. N. McV.

Alumina manufactured from clay. H. PEDERSEN. *Tidsskrift for kemi og bergvesen,* **3,** 161–4, 175–8(1923); **4,** 11–17(1924).—The articles describe processes arrived at through extensive exptl. work. The raw mats. were clay, coal and sulphuric acid (chamber acid). The clay is an ordinary brick clay from quaternary deposits and has the following average compn.: SiO_2 55.0, Al_2O_3 16.0, FeO 7.0, MgO 0.7, CaO 1.0, Na_2O 2.5, K_2O 3.5. The process is approx. as follows: (1) The clay is kneaded and mixed with cold chamber acid, the heat of reaction raising the temp. of the mixt. to 150°C whereby SiO_2 is obtained in an amorphous state and is easily filtered. The mixt. is stored for 12 hours. (2) The dissolved clay is leached out systematically three times. The slimes are removed in filter presses. The brine obtained has a sp. gr. 1.35 and contains about 80 g. Al_2O_3 per l. solution. (3) The brine is cooled to about 15°C, this pptg. about $^1/_3$ of the Al_2O_3 as potassium alum formed by the reaction between H_2SO_4 and the Al_2O_3 and K_2O of the clay. The remaining $^2/_3$ of Al_2O_3 is pptd. by adding to the cold, stirred liquid solid K_2SO_4 obtained from previous production. (4) The raw alum is recrystallized with as little water as possible, a pure alum contg. less than 0.01% Fe being obtained. No filtration is necessary. (5) The pure alum is dried in a gas heated rotary kiln. (6) The dried alum is decomposed in a gas heated rotary kiln in slightly reducing atm. The product consists of Al_2O_3 and K_2SO_4, while the H_2SO_4 originally combined with Al_2O_3 escapes as a gas contg. about 6 vol. % SO_2. (7) The decomposed alum is heated with a cold-satd. soln. of K_2SO_4, the contents of K_2SO_4 thereby being obtained in a warm-satd. soln., which on cooling yields crystd. K_2SO_4. Al_2O_3 is removed from the hot soln. by filtration. The cold-satd. K_2SO_4 circulates in the process. (8) Al_2O_3 is dried at 300–400°C for removal of hygroscopic water. (There is

little loss from dusting contrary to what is the case with the hydrate.)—For 1 ton of Al_2O_3 the following amounts of raw mats. are used: Clay 12 tons (at kr. 1.50), coal 2.5 tons (at kr. 15.00), chamber acid 20 tons (at kr. 25.00). A recovery of 400 kg. pure K_2SO_4 (at kr. 0.25) per ton Al_2O_3 is figured on.—In some introductory paragraphs P. compares different methods and criticizes a method suggested by V. M. Goldschmidt for producing Al_2O_3 from labradorite, stating especially that labradorite yields only 19.5% soluble Al_2O_3, while Goldschmidt claims up to about 30%. O. A.

The solubility of alumina minerals in acids. V. M. Goldschmidt. *Tidsskrift for kemi og bergvesen,* **4,** 9(1924).—A rejoinder to the criticism contd. in the articles of H. Pedersen abstracted above. G. has found that *unaltered* labradorite yields from 20 to 32% Al_2O_3 soluble in HNO_3, while labradorite only partly changed to "saussurite" may be nearly insoluble. Saussurite is a mixt. of zoisite-clinozoisite ($H_2O.4CaO.3Al_2O_3.6SiO_2$) and a lime-soda feldspar rich in soda ($xNa_2O.Al_2O_3.6SiO_2 + yCaO.Al_2O_3.2SiO_2$). G. suggests that the discrepancies may be due to a difference in the labradorite used in the experiments, Pedersen probably having used a somewhat "saussuritized" labradorite. O. A.

Investigations on Norwegian clays. I. J. v. Krogh. *Norges Geol. Undersokelse,* **115,** 1–32(1923).—Some of the more important properties of quaternary clays used in ordinary brick making have been detd. The amt. of H_2O at "normal consistency" varies between 22 and 39%. The drying shrinkage is given with figures between 1 and 11%. The grain size varies widely, the finest clay contg. upwards of 82% of particles smaller than 0.01 mm. and only 0.1% larger than 0.1 mm., while a sandy variety contains 4.6% smaller than 0.01 mm. and 58.3% larger than 0.1 mm. Numerous determinations of softening temperatures gave results between 1050° and 1225°C. Clays fired at 900°C have water absorption between 9.84 and 24.72%, porosity between 21.8 and 37.8%, and sp. gr. between 2.20 and 2.606. O. A.

Investigations on Norwegian clays. II. B. Dietrichson. *Norges Geol. Undersokelse,* **116,** 1–58(1923).—A brief outline of the geology of quaternary (marine) clays of southern Norway is given. Samples collected at brick works are described, details of the geology of the places of collection being given in a number of instances. Sketches and photographs accompany the descriptions. O. A.

Investigations on Norwegian clays. III. J. v. Krogh. *Norges Geol. Undersokelse,* **119,** 1–56(1924).—K. describes expts. on quaternary clays and presents the results in tables and diagrams. The limit of satn. (*i. e.,* contents of water in a clay showing incipient flowage) is detd. on 75 samples with results varying from 12.8 to 72.8% (of dry subs.). The max. press. to which clays of varying water contents may be exposed without flowing are considerably higher for fat clays than for lean ones, the difference increasing with decreasing amount of water. The drying shrinkage is detd. on a large number of different clays using of each clay a number of samples with gradually increasing initial water up to the point of flowage. The results calculated as means for 5 groups of fatness are presented in curves where shrinkage is plotted against initial water. A similar series of detns. is made of the water absorption of clays fired at 900°C. A fired clay attains a min. water absorption at a definite initial amt. of water in the wet clay. This amt. varies somewhat in the different groups of fatness, the average being about 24%. An average temp.-porosity curve shows a maximum porosity at about 800°C, all curves declining abruptly at about 1000°C. The molding pressure has only a small influence on the porosity of the fired clay. Curves of crushing strength plotted against temp. of firing show characteristic features. All the curves have secondary maxima at about 500°C and secondary minima at about 700°C. Actual tests seem to show that an industrial production of bricks fired at only 500°C may be possible. Expulsion of water by pressure is facilitated by rapidly increasing pressures or sharp

concussions on the vessel contg. the clay. The plasticity, defined as the difference between the amt. of water in the clay at the limit of satn. and at normal consistency, varies between 5 and 40 for all the varieties examd. The plasticity-temp. curves decline slowly to 400°C, then rapidly to about 500°C, and again slowly to about 900°C; clay fired at this temp. is practically devoid of plasticity. O. A.

The microscopic structure of clays. LEON BERTRAND. *Recherch. et Invent.*, **4**, 825, 842(1923).—On examn. of 250 secondary French clays B. found an appreciable amt. of mica in only 3 or 4. He concludes that the alkali content usually occurs uncombined, being adsorbed by the clay colloid. He found iron most often present as a hydrated oxide. The free silica particles vary greatly as to size. One clay contained 17% hydrated silica, making it less refractory than a clay with the same amt. of coarse quartz. B. found the clay base itself to be composed of colloids, cryst. kaolinite, as found in kaolin, and cryptocryst. mat., especially abundant in halloysite. Most clays without the addn. of feldspar show granular sillimanite when fired to 1300°, and its formation is almost independent of any fluxes present. Interlacing needles of sillimanite, however, may not develop below 1600°, and a vitreous structure seems necessary for its formation. A high flux content will lower the latter temp., but all fluxes do not act the same. B. contends that the quality of paving brick is largely detd. by the amt. of these needles. P. W. K.

The industrial applications of the electric furnace. E. W. LEWIS. *Engineering* (London), **116**, 257–9(1923).—The charac. of the elec. fur. are const. and regular ht. distribution and accurate automatic control of the temp. The two types of elec. fur. generally used are the induction and arc or modifications of these two types. A. c. is used in indus. applications. The principal uses are: (1) Smelting of iron ores; (2) manuf. of steel; (3) fixation of atmospheric nitrogen and ammonia oxidation; (4) heat treatment in the automobile industry; (5) manuf. of CaC_2; (6) in the annealing of glass, the elec. fur. is rapidly supplanting the fuel-fired fur., due to the accurate control of temp., uniformity of the ht. application and the even distribution of the ht. In the manuf. of fused silica ware silica is heated in an elec. fur. to its m. p. (1800°C). W. E. R.

Determination of melting points. WM. JONES. *Fuels and Furnaces*, **1**, 455–60 (1923).—The detn. of the m. p. or f. p. of a substance is based on the fact that the temp. of the mass remains const. during the transition from the solid to the liquid phase, or vice versa. From a time-temp. curve the m. p. is obtained. From a time-e. m. f. curve for pure substances of known m. p. thermocouples may be calibrated. W. E. R.

The determination of the calorific value of liquid fuels. NELSON HARWOOD. *Engineering* (London), **116**, 396(1923).—By means of an adjustable mercury column acting on a reservoir liquid fuel is delivered to a suitable burner at const. pressure. The fuel is burned at a const. rate in a gas calorimeter of the Junker type. After temp. equil. is attained in the instrument the calorific value is calcd. from the amt. of fuel burned and the quantity of ht. delivered to water circulating through the calorimeter. W. E. R.

The laws of heat transfer. ANON. *Engineering* (London), **116**, 1–3, 69–70, 131–2, 228–30(1923).—Deductions from exptl. data published by G. C. Webster and others. The resist. to the transfer of heat between a tube and a fluid traversing it, in normal turbulent flow, must consist of two terms one of which is independent of the thermal condy. of the fluid while the other term includes this condy. as a factor. The first term is Reynold's convective resist. which is a modification of the proportion $R = v/F$, in which R denotes resist. to transfer of heat, in C. G. S. units, v denotes mean velocity of flow in cm. per sec., and F is the frictional resist. experienced by the fluid per unit area of wall surface in dynes per sq. cm. The second term is the film resist. A con-

siderable fraction of the resist. to heat transfer between a tube and a fluid traversing it is to be ascribed to the existence of a film of the fluid which creeps along the walls in a state of viscous flow. At temperatures above 80°C air contd. in water will be given off, breaking up this film and changing the law of heat transfer. The actual thickness of this film is expressed as a fraction of a mathematically deduced ideal film thickness. The thermal resist. of the film per sq. cm., $R_f = \varphi f_1/c$, in which f_1 denotes the thickness of the ideal film, φ is the ratio of the actual film thickness (f) to the ideal film thickness, and c is the sp. condy. of the fluid. Exptl. evidence indicates that φ is a const. and equal to 0.55. The ratio of the ideal film thickness to the radius of the tube is expressed by the formula $f_1/a = 1 - \sqrt[4]{1 - 8\bar{\mu}v/dF}$ where a denotes the radius of the tube, $\bar{\mu}$ is the mean viscosity of the film, and d denotes the diam. of the pipe. By this equation the film thickness is always a finite quantity however large v or d may be. By substitution, $R_f = 0.55d/2c\,(1 - \sqrt[4]{1 - 8\bar{\mu}v/dF})$. The total resist., R, to the transfer of heat is given by $R = R_r + R_f$. R_r is the modification of the convective resist. formula: $R_r = (1 - \varphi)v/F$. The total resist. then is $R = 0.45v/F + 0.55d/2c(1 - \sqrt[4]{1 - 8\bar{\mu}v/dF})$. When the greatest thickness of the film is less than $^1/_{100}$ of the radius its condy. can be calcd. as if it were flat. In ordinary condenser practice the film may be as much as $^1/_{20}$ of the radius in which case its resist. would be about $2^1/_2$% more than if it were flat. $Q = \Delta T/R$, where Q is the heat flow in cal. per sq. cm. per sec. and ΔT is the difference between temp. of the inner surface of the tube and the mean water temp. If R is known under given conditions for a tube of internal diameter d, at corresponding speeds and with the same water and wall temperatures the resist. of a corresponding tube of internal diameter D is found by multiplying the known resist. by D/d. For fluids other than water the formula should read $R = 0.45/s \times v/F + 0.55d/2c\,1 - \sqrt[4]{1 - 8\bar{\mu}v/dF})$, where s is the sp. heat of the fluid traversing the pipe. W. E. R.

The stresses in cylindrical and spherical bodies due to differences of temp. inside and out. CHAS. H. LEES. *Trans. Ceram. Soc.*, **22** [3], 241–7(1923).—A hollow cylinder of circular section, originally at air temp. throughout, is heated till its outside surface is at 1000°C. To find the stresses in the material, its expansion and its elastic constants were given. In all cases considered the stresses in the mat. were due to the rise or fall of the temp. of the mat. from some uniform to some non-uniform distribution, and the values given are for the stresses which exist in the non-uniform condition. H. F. S.

Sodium-aluminium fluoride practically free from silica. HUMANN & TEISLER CHEMISCHE FABRIK DOHNA. Ger. 348,274 (*Oil and Color Trade Jour.*, **65**, 226 (1923)).—The amt. of sodium salt needed for the formation of the double fluoride is gradually added and stirred into the warm reaction liquid. 1 kg. of kaolin, suspended in water, is dissolved in 4 kg. of 40% hydrofluoric acid, the soln. being decanted from the sediment and treated with 620 gr. of carbonate of soda. A ppt. of 1 kg. of the double fluoride (dry substance) is thrown down, while the silicic acid of the kaolin remains in soln. as hydrofluosilicic acid. O. P. R. O.

Electrical conductivity in the zeolites. O. WEIGEL. *Z. Krist. Festband P. v. Groth*, **58**, 183–202(1923).—The purpose of this investigation was to det. whether the H_2O in zeolites is present as mols. or ions; it is shown to exist, in part at least, as ions. By using dry metallic electrodes and a quartz fiber electrometer the condy. of several zeolites was detd. The sp. resistance (cm. ohm) was found to be: stilbite, 2 to 5 $\times 10^8$; heulandite, 4 to 8 $\times 10^{10}$; chabazite, 2 to 3 $\times 10^8$; natrolite, 1.5 to 1.6 $\times 10^{12}$; apophyllite, 1.7 $\times 10^{13}$; analcite, 6 $\times 10^9$. This resistance is low for non-metallic minerals, and is due to the at least partially ionized H_2O content, and not to the cations. This was demonstrated in 2 ways: (1) partial dehydration greatly increased the resistivity of heulandite; (2) substitution of H_2O electrodes notably decreased the resistivity of

several zeolites. The condy. is closely dependent on temp.; for heulandite the sp. resistivity was halved by a rise of 8° in temp. (from 16° to 24°). E. F. H. (*C. A.*)

Specific heats of gases. C. DE LA CONDAMINE. *Chaleur et ind.*, **4**, 64(1923); *J. Soc. Glass Tech.*, **7**, 118; cf. *C. A.*, **17**, 2042.—The sp. heat of gases at const. pressure varies only slightly with the pressure. Thus for air over a temp. range of 27–77° Lussana found a variation of only 0.0015 per 1 atm. change, while at 60° Holborn and Jakob gave a variation of 0.0003 per atm. Lussana found for CO_2 a change of sp. heat at const. pressure of only 0.002 per 1 atm. change, a variation of only 0.9%. Theoretically it could be shown that $dC_p/dp = 2aA/RT_2$, so that the variations of the sp. pressures would be less at higher temps. A table and curves for finding the heat required to raise 1 kg. of steam, air and other gases over varying temp. ranges at varying pressures were given. C. H. H., JR. (*C. A.*)

PATENT

Aluminates. J. KORITSCHONER and F. HANSGIRG. Brit. 199,017, May 30, 1923. Aluminiferous materials such as bauxite are mixed with alk.-earth compds. such as lime and with C in certain proportions and fused in an elec. or other furnace. The product is cooled and powdered, and is leached with a soln. of an alkali such as Na_2CO_3 to obtain alkali aluminate. The leaching may be effected at 100°. The proportion of Al_2O_3 to CaO may be 47.5 to 52.5 and the quantities given in an example are 64.9 parts bauxite, 36.9 parts lime, and 10 parts charcoal. It is stated that metallurgical processes, especially the production of Fe in blast or elec. furnaces, may be carried on so that the slag contains lime and Al_2O_3 in the above propns. so that the Al_2O_3 may be extd. from the slag as above described. (*C. A.*)

General

The distillization of bituminous limestones for the production of mineral oils. LA REDAZIONE. *Giorn. Chem. Ind. ed Applic.*, **5**, 537(1923).—This is a review of the work being carried on by various organizations in Italy for the removing of asphalt oils from limestone. The large deposits occur in Sicily where it is calculated are 320,000,000 T. of rock. A use of the burned rock is being investigated. S. S. C.

Bituminous limestones of Abruzzo and the possible utilization of the distillates. D. MENEGHINI. *Giorn. Chem. Ind. ed Applic.*, **5**, 545(1923).—This rock varies from 5–15% volatiles and about 1–2.5% S. The temperatures of distillation are from 350–375°C. The products formed are ammonia, CO_2, benzol, asphalt oil and tar. Methods of determining S in the oil are discussed and results of per cent of S obtained by various methods are given. The amt. of S in oil varies from 6.8–10.4%. S. S. C.

Non-metallics in 1923. N. B. DAVIS. *Can. Min. Jour.*, **44** [1], 19(1924).—A brief review is given of the developments in production and uses of important non-metallic minerals during the year in Canada. B. M. L.

Saskatchewan's place in Canadian ceramics. W. G. WORCESTER. *Can. Min. Jour.*, **44** [1], 25(1924).—The Univ. of Sask. has included the first and only ceram. engineering course in Canada in its curriculum. Work has been started with Gov't coöperation in the survey of ceramic resources and the testing of clays of Sask. Among the known and tested clays are those suitable for pottery and light ware, for heavy clay products, and for refractories, indicating very diversified clay resources. Pottery, sewer-pipe, building brick, and refractories are now manufactured. Fuel resources are now limited to very large lignite coal deposits and some natural gas. Water supplies and transportation are satisfactory. B. M. L.

Mining in 1923. ANON. *Eng. & Min. Jour.-Press*, **117** [3], 87, 93–7(1924).—Interesting, brief comments are included on the 1923 developments in the production,

imports, exports and prices of asbestos, bauxite, borax, diatomite, feldspar, fluorspar, kaolin, magnesite, mica, silica, talc, etc. B. M. L.

Conservation of heat in power and heating systems. E. R. WEIDLEIN. *Trans. Am. Inst. Chem. Eng.*, **13** [2], 25–42(1921).—The article includes the results obtained up to 1920 at the Mellon Institute in the study of the properties of "85% magnesia" as a heat insulating covering for steam pipes, etc. Good heat insulators usually owe their value essentially to the presence of a large volume of dead air spaces entrapped in a porous mat. "85% magnesia" contains 90% of voids. It is made by mixing 85 parts of pure basic carbonate ($4MgCO_3.Mg(OH)_2.5H_2O$), made by a chem. process from dolomite, with 15% of asbestos fiber, molded to shape, dried 5–6 days, and planed to accurate sizes. The mat. absorbs about 3 times its own wt. of water. Repeated wettings and dryings do not materially affect its properties. Some blocks of the mat. were found to have increased 3% in insulating value after 16–20 years' service. Saturation with oil, however, caused permanent damage to the insulating efficiency. Coverings were used up to 800°F and were in perfect condition after 4 yrs. of service. Ordinarily pipes will rust less rapidly when covered than when bare. Tables and curves are included which show costs of insulation, savings in heat, coal and money, etc. A method is outlined for calcg. the most economical amt. of insulation. B. M. L.

Effective B. t. u. and cost determine value of coal. A. BEMENT. *Power*, **58** [12], 448–50(1923).—The calorimetrical B. t. u. value of coals as determined in a lab. does not always give true practical comparisons; the calorimeter process is perfect whereas practical usage of the coal is often very imperfect. A term known as "effective B. t. u." has been devised. It is by this term that coals should be compared rather than by the lab. B. t. u. A simple method of obtaining the effective B. t. u. is given. Emphasis is laid on the fact that oftentimes the cost of coal at the mines is compared, whereas cost at the point of delivery is what should have been used in the comparison. Examples are given showing that good coal will often pay for itself because less draft is needed, resulting in a lower necessary grate area and possibly fewer boilers. Poor coal means greater losses resulting from less efficient combustion because of coke and coal with the ash and higher stack temps. C. J. H.

Fuel oil and viscosity. M. G. LAUGHAM. *Power*, **58** [11], 423–4(1923).—The purchase of fuel oil was for many years made without any specifs. Later a gravity reading was introduced because it was, in general, an indication of the ease of atomization. With the advent of heavy crudes from the Southwest, gravity readings have become less reliable because of the difficulty of reading them and also because suspended water affects the accuracy. Since the ease of burning is generally dependent upon the fluidity of the oil to the burner, this important characteristic or its reciprocal, viscosity, must be considered. Temp.-viscosity curves show that different fuel oils must be heated over a wide range of temperatures in order to produce similar viscosity characteristics. Also oils of nearly the same gravity should not necessarily be heated to the same temp. in order to be of the same viscosity. Improper viscosity may result in inefficient burner operation. One of the leading burner manufacturers recommends a viscosity of 8° Engler for best operation of his burner. An important point is that the viscosities of certain Mexican oils change under certain conditions of storage depending upon the storage temp. The viscosity does not always change instantly with temp. The capacity of the oil heater depends to a large extent upon the viscosity of the oils passing through it. A great deal could be done to decrease the annual waste if engineers would give closer attention to the phys. characteristics of viscosity. C. J. H.

Oil shale in Tasmania. ANON. *Chem. Eng. and Mining Rev.* (Melbourne, Victoria), **16**, 102(1923).—The shale is finely laminated, brown in color, sectile, tough and resistant to weathering agencies. It is capable of being converted into petroleum prod-

ucts by destructive distillation, samples tested give from 46 to 64 gal. of oil to the ton. In the retorting opern. there are 3 products; crude benzine: kerosene and light lubricating oils; and heavy lubricating oils; this is claimed to be a new departure. The oil shale exists in large quantities, a conservative estimate of the tonnage in 3 leases (totaling 1488 A.), on Mersey River, near Latrobe, has been made at 5,580,000 T.

O. P. R. O.

Australian Chemical Institute. DAVID MASSON. *Chem. Eng. and Mining Rev.* (Melbourne, Victoria), **16,** 103(1923).—At a general meeting held in Sydney, David Masson, first president, announced the incorporation of Australian Chem. Inst. as at Sept. 17, 1923; the first annual meeting to be held in Nov., 1924. O. P. R. O.

Oil sands (South Australia). W. A. HARGREAVES. *Chem. Eng. and Mining Rev.* (Melbourne, Victoria), **16,** 116(1923).—Analysis of the oil film issuing from the bore, at a depth of 1,110 ft., where a 3 ft. belt of oil sand was reported, shows: bitumen 17.6%; mineral oil 74.3%, saponifiable oil 8.1%. O. P. R. O.

The influence of ceramics on the development of the chemical industry. FELIX SINGER. *Chem.-Ztg.,* **47,** 450–1(1923). E. J. C. (*C. A.*)

PATENT

Purifying clay. W. FELDENHEIMER and W. W. PLOWMAN. Brit. 199,795, March 27, 1922. A process for the purification of clay comprizes peptization of the clay in an aq. soln. of caustic alkali, such as NaOH, which contains the hydroxide of an alk.-earth such as Ca, Ba, or Sr, the amt. of reagents added for suspending any given clay being varied according to the hardness of the water used. The soln. of mixed hydrates may be obtained by the interaction of an excess of caustic alkali and an alk.-earth hypochlorite such as bleaching powder in the presence of H_2O. The suspension of clay may be sepd. from the unpeptized impurities, when such are present, and the clay recovered in any desired manner. A sol. hypochlorite may also be present in the liquid for bleaching, deodorizing and sterilizing the clay, in which case a longer period of contact is usually necessary, or the hypochlorite may be added to the suspension after the impurities, if any, have been removed. See *Ceram. Abs.,* **2** [3], 51(1923); *ibid.,* **2** [6], 138; *ibid.,* **2** [8], 190.

IT is now time to begin thinking about the summer meeting on the Pacific Coast. This is going to be a wonderful opportunity to visit plants about which you have been hearing. Note the various items of equipment in these plants and see for yourself the relation between them and Journal advertisers.

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American Ceramic Society

Lord Hall, O.S.U. Columbus, Ohio

CERAMIC ABSTRACTS

Compiled by the

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Abrasives

Vitreous enameling in the electric furnace. J. L. McK. Yardley. *Elec. World*, **82**, 327; *Chem. Met. Eng.*, **29**, 55–8(1923).—Recent furnace improvements include carborundum or carbofrax brick muffle, intermittent gas fire and elec. heat. Carborundum has $^1/_8$ the thermal resistance of fire clay. In the intermittent furnace, gas is burned directly in the chambers and heated above the required temp. Then the gas is turned off and the enamel is fused under falling temp. With 500 B.t.u. gas at 50 cents the fuel cost with intermittent gas furnace is 9 cents per 100 lbs. or 10 cents per 100 sq. ft. of surface. Cost in elec. furnace will be as low if power cost is 1 cent per kw.-hr. Furnaces for watch dials, bath tubs and sheet Fe are described and other cost data given. R. J. M. (*C. A.*)

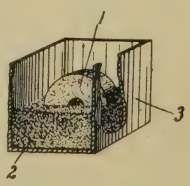
Report of Refractory Materials Committee. Jointing materials for silica refractories. D. Jones and W. Emery. *Gas J.*, **163**, 157–9(1923); *Gas World*, **78**, 646; cf. *Ceram. Abs.*, **2** [11], 255(1923).—The more nearly a jointing cement approaches in chem. compn. and phys. behavior that of the bricks with which it is used, the more satisfactory are the results obtained. Examn. was made of the effect of mixing in various proportions, fire clay, ganister and crushed silica brick, and, in some cases, of adding plaster, lime and Na_2SiO_3. Mixts. of the 3 first materials, having either equal or greater proportions of ganister to crushed silica brick, give very good jointings. A high % of the latter renders the cement mechanically weak. For the bonding material, a small % of a highly plastic refractory clay is more satisfactory than a large proportion of fire clay of a less plastic nature. No advantage is obtained by the addn. of such materials as plaster, lime or Na_2SiO_3 to a cement which is to be used at high temps. J. L. W. (*C. A.*)

Abrasive materials in 1922. L. M. Beach and A. T. Coons. U. S. Geol. Survey, *Mineral Resources of U. S., 1922*, Pt. II, 221–5(preprint No. 25, publ. Dec. 3, 1923). See *Ceram. Abs.*, **3** [4], 109(1924). E. J. C. (*C. A.*)

PATENTS

Process of treating the surfaces of crystalline mineral materials. Miner L. Hartmann. U. S. 1,482,792, Feb. 5, 1924. The process of treating the surface of cryst. mineral material which consists in heating said material in contact with a halogen salt to a temperature sufficient to produce a surface reaction between said mat. and said salt but insufficient to produce glazing of the surface of said mat.

Process for treating surfaces of crystalline mineral material. Miner L. Hartmann. U. S. 1,482,793, Feb. 5, 1924. The process of improving the bonding quality of crystalline mineral materials, which consists in moistening the material with a surface pitting acidic substance and heating to a temperature sufficient to produce a surface pitting reaction, but insufficient to produce glazing of the surface of the crystals, substantially as described.



Method of making abrasive wheels. Peter Joel Styffe. U. S. 1,485,132, Feb. 26, 1924. The method of making an abrasive wheel, comprising the steps of supporting the wheel consisting of granular abrasive and heat setting bonding material upon a substantial portion of its peripheral face by a refractory, retaining the wheel in such position and firing it while in this position to bond the abrasive grains.

Art

Forgeries of ancient stained glass. Methods of their production and detection. J. A. KNOWLES. *J. Roy. Soc. Arts*, **72**, 38–56(1923); 7 figs. G. E. B. (*C. A.*)

PATENT

Beads. C. SEIDEL and N. BOTER. Brit. 204,627, Jan. 22, 1923. Beads, especially glass beads, are rendered iridescent by coating them with resin or a resinous substance, heating to fuse the resin, and exposing them to the fumes evolved by $SnCl_4$, $TiCl_4$, or other metallic compd. producing white vapors. (*C. A.*)

Cement, Lime and Plaster

The concrete masonry house today, the fireproof house tomorrow. ANON. *Concrete*, **24**, 41–3(1924).—The concrete masonry walled house which displaces other kinds of masonry, besides frame and veneer, is one kind of development; the other is the fireproof house with concrete floors and other unburnable features. Through its district representatives in all parts of the country, the Port. Cement Assn. compiled data which show that production of concrete block and structural tile of all styles and dimensions reduced to a volume term of 8 x 8 x 16 in. blocks amounted in 1920 to 50 million; in 1921 (a more complete survey), 175 million; in 1922, 297 million; and in 1923, 385 million. The production of concrete brick in 1923 is figured at 155 million. Reducing block to brick (1 block equaling about 13 brick) the 385 million block are the equivalent of a little more than 5 billion brick, and, adding the 155 million of concrete brick, concrete building units (not including dimension stone) total an equivalent of more than 5 billion, 185 million for 1923. Compare this with an estimated common clay brick production in 1923 of 6 billion. It is not to be assumed, however, that concrete units are displacing clay brick at any such rate. Concrete building units are swelling the total of masonry construction. It is getting business that clay units might have had if the clay industry had put a greater promotional effort behind its products and had no such formidable competition. F. T. H.

Rapid slaking of lime. J. E. DUCHEZ. *Rev. Mat. Constr. Trav. Pub.*, **164**, 80–2; **165**, 104–7; **166**, 127–30(1923).—In slaking burned lime contg. silica and alumina just sufficient water is added to slake the lime but not enough to hydrate any silicates or aluminates. The quantity of water to be used can be calcd. from the empirical formula, % water by wt. $= c-1.7(a+b)/3$, in which the chem. compn. in wt. % is a SiO_2, b Al_2O_3 and Fe_2O_3, c CaO and MgO. The formula is derived from the following considerations: The compds. formed from SiO_2, Al_2O_3 and CaO in making hydraulic cements are mainly $SiO_2.2CaO$, $SiO_2.3CaO$, $Al_2O_3.3CaO$ and free CaO. In burning lime with mol. compn. x SiO_2, y Al_2O_3, n CaO, granting that the above compds. are formed the max. and minimum free lime left for hydration will be: (*a*) $x(SiO_2.2CaO) + y(Al_2O_3.3CaO) + [n-(2x+3y)]CaO$; (*b*) $x(SiO_2.3CaO) + y(Al_2O_3.3CaO) + [n-3(x+y)]CaO$. As the free lime only should be hydrated, the limits for the water content are: $[n-(2x+3y)]H_2O$ and $[n-3(x+y)]H_2O$. Converting the % chem. compn. of the lime into mol. ratios gives, $0.93a$ SiO_2, $0.55b$ Al_2O_3, $1c$ CaO. Substituting these values, the limits in wt. % are $^1/_3[c-(1.80a+1.65b)]$ and $^1/_3c-[(2.80a+1.65b)]$; the fraction $^1/_3$ being the ratio of water to lime used for slaking theoretically pure lime. Equalizing the factors in the max. limit gives the empirical formula. The calcd. values agree with the quantities used in practice:

Lime from: wt. % compn.	Tarn.	Aude.	Cantal.	Basses-Alpe
SiO_2	4.5	0.75	16.32	25.21
Al_2O_3 and Fe_2O_3	3.1	0.32	4.00	1.32
CaO and MgO	91.94	97.70	77.58	72.00

Water of hydration: wt. %				
Calcd. from formula	26.04	31.29	14.34	8.96
Used in practice	25	32	15	10

Lime crushers, hydration systems and storage bins are described with special reference to installations made by the author. L. N.

Heat balance of a rotary cement kiln. CH. BERTIN. *Rev. Mat. Constr. Trav. Pub.*, **164,** 97–100; **165,** 121–3(1923).—Calcns. are given to show that in firing a rotary cement kiln with coal the usual distribution of heat is as follows: (1) for evapn. of water 30%, (2) losses of heat through stack 14%, (3) losses by radiation from metal covering 6%, (4) losses due to cooling of the hot clinker 12%, (5) leaving 38% of the heat used for the actual decompn. of the carbonates and for starting the chem. reactions. It is recommended that where possible less water be used for mixing, that provisions be made for draining off excess water, that the stack heat be utilized in heating up the water used in mixing the raw materials, and that the air for combustion be preheated by the heat generated by the cooling clinker mass. L. N.

Manufacture of cement tile. P. LOZACH. *Rev. Mat. Constr. Trav. Pub.*, **167,** 187–9(1923).—A general description of the process of making cement tile. L. N.

Note on the use of liquid fuel in the ceramic industry. ALIX CORNILLE. *Rev. Mat. Constr. Trav. Pub.*, **167,** 142–3B(1923). L. N.

Recommended specifications for quicklime and hydrated lime for use in the manufacture of sand-lime brick. ANON. Bur. of Stand., *Circ.* **150.**—This is the 6th of a series of specifs. for the lime used in various chem. industries. To assist in the development of these specifs., the bureau has called together an Interdepartmental Conference on Chem. Lime, composed of representatives of the Geological Survey and Bureau of Mines, of the Interior Department; the Bureau of Soils, Bureau of Chemistry, Forest Service, and Fixed Nitrogen Research Lab. of the Department of Agriculture; and the Chem. Warfare Service of the War Department. The present specifs., based on a draft originally prepared by W. E. Emley, of the lime section, Bureau of Stand., has been unanimously approved by the above conference and by the Nat. Lime Assn. Either quicklime or hydrated lime may be purchased for making sand-lime brick, but the former must be completely hydrated before it can be used. Mat. of about 85% purity and reasonably low in magnesia is required. The lime must also be reasonalyb fresh, as indicated by a low content of carbon dioxide. Methods of anal. are given in detail. H. F. S.

Wall plaster: Its ingredients, preparation and properties. ANON. Bur. Stand., *Circ.* **151.**—The art of plastering is intimately connected with the comfort and safety of the occupancy of buildings, yet few outside the trade understand the nature of the mat. and the details of the work required to produce the desired results. The recently aroused interest in building has carried with it interest in plastering. Much information about the factors which enter into successful plastering was found available in the trade. This paper represents an attempt to collect and correlate this information for the public benefit. To assist in the work, a committee known as the Bureau of Standards Plastering Conference was organized of men most familiar with the different phases of the subject. From the information thus furnished, and from lab. research work, we have been able in many cases to explain not only how an operation is conducted but also why this is the best way of doing it. It is recommended that furring be used when plastering exterior masonry walls, to prevent damage due to condensed moisture. When masonry walls are to be plastered without furring, the surface of the masonry should be true and clean and of proper degree of wetness. Specifications and directions for erecting are given for wood, wire and metal lath, and gypsum plaster board. Descriptions and specifs. are given for the ingredients of plaster—lime, gypsum, cement, sand, hair,

water, etc. The chief properties of the wet mix. are discussed, as they affect the quality of the finished plaster. Complete directions are given for the mixing of the ingredients and the application of the wet mix. to the wall. The chief properties of the hardened plaster are discussed as they affect the comforts and safety of the occupant. Different kinds of decorative features are described. Some of the common defects are described, and their causes and remedies suggested. Attention is called to the factors to be considered when selecting materials for plastering in order that they may be best adapted to the particular case. H. F. S.

Recommended specifications for quicklime and hydrated lime for the manufacture of silica brick. ANON. Bur. Stand., *Circ.* **153.**—A brief description of the way in which lime is used in the manuf. of silica brick is followed by a gen. statement as to the quality of lime required. The stand. of quality is set at 92% based on the nonvolatile matter, with max. limits of 5 and 10% carbon dioxide, depending upon whether the sample is taken at point of shipment or of destination. Complete directions for sampling and testing are included. H. F. S.

The chemico-technical and mechanical properties of caustic magnesite. ANON. *Bäumaterialien-Markt. Leipzig,* **36** and **38**(1921).—This publication consists of two lectures delivered before the general meeting of the Verband Deutscher Steinholzfabrikanten in Nurnberg dealing with the tests of caustic magnesite as a building material. The researches were carried out by L. Jesser in collaboration with chemists of the laboratory of the Austro-American Magnesite Company. In determining the value of caustic magnesite for use as a building material chemical tests are not adequate. The important tests are for fineness of grind, hardening characteristics, volume stability and tensile strength. The fineness test is made by screening through two sieves of widely different sizes of mesh opening. The test for set or hardening is a "pat" test carried out as follows: 100 grams of the magnesite is kneaded with about 40 to 50 cc. of a 20° Bé magnesium chloride solution to a standard consistency. The mass is formed into tapering pats on a glass plate. The resulting hardness is then determined with the Vicat needle. The material should have a setting time of between 2 and 5 hours. In making this test the pat should be covered to prevent rapid drying. The test for volume stability is made by mixing the magnesite with pine sawdust in the ratio of 1 to 2 by volume (3 to 1 by weight) moistening with 20° Bé magnesium chloride solution and making into forms by gentle pressing. After 24 hours the samples are removed and measured. It is assumed that the formation of the Sorel Cement is complete in this time. The measurements are kept up every day for 1 month. The most significant results are obtained, however, during the first 10 or 14 days. The volume change should not amount to an expansion of more than .15% of the length nor to a contraction of more than .25% of the length. The air to which the specimens are exposed should not vary more than 6% from a relative humidity of 60%. The sawdust should consist of 50% 0–.1 min., 10% 1 to –1.5 min., 40% 1.5–2 min. The test for tensile strength is to be made on the same material as was used in the preceding test. Tests should be made after 3, 7 and 56 days. After 3 days the tensile strength should be more than 8 and less than 25 kg. per sq. cm.; after seven days not less than 20 kg. per sq. cm. and after 56 days not less than 40 kg. per sq. cm. M. E. HOLMES

The action of sugar on cement mortars. CONSTANTIN TSOUNTAS. *Bull. inst. Egypte,* **5,** 157–62(1923).—Expts. confirmed previous statements as to the deteriorating effect of the presence of sugar in the water used for making cement mortars. The time required for setting was considerably shortened. The resistance, in the hot water test of Le Chatelier, was destroyed. The resistance was lowered as the sugar content increased to the point where, with high concns., the mortars completely disintegrated. This effect of sugar is a serious factor only in the neighborhood of sugar mills. P. R. D. (*C. A.*)

Fused cement or "Alcement." RUD. CHRISTIANI. *Teknisk Ukeblad*, **41**, 143–66 (1923).—The author gives the procedure for manufg. fused cement. The fusion is carried out in elec. furnaces or in water-jacketed furnaces. The raw materials are bauxite and lime. The av. compn. of alcement is approx. 40 CaO, 10 SiO_2, 40 Al_2O_3 and 10% Fe_2O_3. The main chem. constituents are Ca aluminates. The compn. of the raw mixt. can be varied within very wide limits and still good cements be obtained. The rate of cooling has a great influence upon the qualities of the fused cement. Per ton of alcement 2000 kw. hr. + 100 kg. electrodes is required for elec. fusion and 750 kg. coke for fusing in water-jacketed furnaces. A report is given of a series of assays made to compare the alcement with com. Port. cements. Alcement hardens much more quickly than do the com. cements. By tests with neat cement as well as with usual mortar mixts. the alcement showed greater tensile and crushing strengths than com. cements, in most cases even when aged for more years. The results are given in several tables. Only small differences are found between the strengths obtained by water-hardening and those obtained by air- or combined hardening. Driving tests to compare the resistance of poles molded from ordinary concrete and from alcement concrete and aged for different periods showed a considerable difference in favor of the latter. This is also said to be completely sound in all cases. It is more acid-proof than Portland cement. Neat alcement evolves a considerable amt. of heat during the binding, but in concrete mixts. this effect is of no importance. The Dan. State Lab. for Testing Materials found the following compn. of a sample of alcement: SiO_2 10.0, Al_2O_3 37.8, Fe_2O_3 0.2, FeO 5.5, FeS 0.6, TiO_2 1.7, CaO 42.4, MgO 0.3, SO_3 0.7, and moisture 0.3%.

C. H. A. S. (*C. A.*)

Enamel

Wet-process enamels for cast iron. R. R. DANIELSON AND H. P. REINECKER. Bur. Stand., *Tech. Paper* **246**.—Part of the results given in this paper are reported in *Jour. Amer. Ceram. Soc.*, **5**, 647–69(1923). Wet-process enameling of cast iron is becoming of importance because of its application to the enameling of stove parts, sanitary fittings, and hardware. This paper is a report of an extended investg. of wet-process enamels for cast iron, both with and without the use of ground coat. Compns. used in dry-process enameling have served as a basis for the work. The effect of varying methods for prepn. of the frits, mill additions, and relation of compn. of the enamel to such properties as adherence, texture, and opacity have been carefully studied. *Ground coats.*—Sintering of most ground-coat frits has been found desirable in order to develop best adherence of the enamels to the casting. Clay gave best results as a mill addition

GROUND COATS

Batch Compns. of Frits

Enamel	Flint	Borax	Sodium nitrate	Soda ash	Red lead	Boric acid
Rg-1	69.90	36.96	6.95	..	8.17	..
Rg-17	69.90	36.96	6.95	..	4.08	7.08
Rg-18	69.90	26.07	6.95	3.04	12.24	..
Rg-25	69.90	26.07	6.95	9.88	8.17	..
Rg-26	66.30	36.96	6.95	..	8.17	6.37

for the ground coats and flint and feldspar were found to be less satisfactory. Excessive additions of clay or flint produced flaking of the ground coat, while feldspar tended to develop blistering. About 15% of clay or 10% each of clay and flint are recommended as mill addition for the ground coat. Excessive additions of any one flux were not desirable and best results were obtained in more or less definite proportions. Sodium

oxide in excess of about 10% gave rise to blistering. Boric oxide increased the firing range of the ground coat and was preferable to lead oxide on this account, although it tended to promote crawling of ground coats high in boric oxide if they were applied somewhat heavily. The best ground coats developed are given in the accompanying typical batch compns.

Mill additions.—15% of clay or 10% each of clay and flint based on the wt. of the frit, with such additions of water as may be necessary. *Cover enamels.*—These were smelted by the usual method for enamels. The mill additions consisted of 5% of clay, 8% of tin oxide, and 45% of water, all based on the wt. of the dry frit. For best results the cover enamel must be adapted to the ground coat in refractoriness. Boric oxide increased the firing range of the enamel, but tended to promote crawling, although this was less pronounced in the case of the more fusible compn. Boric oxide improved the capacity when substituted for such fluxes as sodium and lead oxide. Cryolite increased capacity, but additions above 10% tended to promote crawling. The following compns. are typical of those which gave satisfactory results:

WHITE COVER ENAMELS

Batch Composition of Frits

Enamel	Feld-spar	Flint	Borax	Sodium nitrate	Red lead	Zinc oxide	Fluor-spar	Cryo-lite	Boric acid
R-1	38.0	12.0	24.52	6.20	3.86	16.42	6.0	5.5	..
R-11	33.0	12.0	24.52	6.20	3.86	21.60	6.0	5.5	..

WHITE COVER ENAMELS

Batch Composition of Frits

Enamel	Feld-spar	Flint	Borax	Sodium nitrate	Soda ash	Red lead	Zinc oxide	Fluor-spar	Cryo-lite	Boric acid	Barium carbonate
R-1	38.0	12.0	24.52	6.20	3.86	16.42	6.0	5.5	5.0	..	..
R-11	33.0	12.0	24.52	6.20	3.86	21.60	6.0	5.5	5.0	..	..
R-14	38.0	12.0	10.90	6.20	7.70	21.60	6.0	5.5	5.0	..	..
R-18	33.0	12.0	24.52	6.20	3.86	16.42	6.0	5.5	10.0	..	..
R-28	40.0	..	54.5	5.95	..	10.3	5.0	5.5	..	8.85	4.5

Single-coat colored enamels.—These enamels are smelted in the same manner as used in the prepn. of the white cover enamels. The effects of the various ingredients are very similar to those noted in the case of white cover enamels. Suitable mill additions consist of 4% of clay, 50% of water, and the necessary amts. of color oxide to give the colors desired. The feldspar type of enamels are apparently more satisfactory than those containing flint as the sole refrac. The following compns. are typical of those which have given very satisfactory results:

SINGLE-COAT COLORED ENAMELS

Batch Compn. of Frits

Enamel	Feldspar	Borax	Sodium nitrate	Red lead	Soda ash
Ro-6	47.05	36.94	4.63	27.81	7.64
Ro-5	47.05	50.57	4.63	22.71	3.90

Single-coat white enamels.—In the production of white single-coat enamels it is necessary to develop max. opacity in the frit, since the addition of more than 3 or 4% of tin oxide in the mill batch caused blistering of the enamel when applied to the iron. Suitable mill additions for enamels of this type are as follows: Clay, 4%; tin oxide, 4%; and water, 45%. In no case were the results with the single-coat white enamels as satisfactory as

those obtained with a white enamel applied over a ground coat, particularly in regard to the opacity. The following enamels are typical of those which gave the most satisfactory results:

SINGLE-COAT WHITE ENAMELS

Batch Compn. of Frits

Material	Ro-16	Ro-38
Feldspar	45.05	45.05
Borax	50.57	39.67
Sodium nitrate	4.63	4.63
Red lead	22.71	22.71
Soda ash	3.85	6.87
Antimony oxide	2.00	2.00
Cryolite	0.00	4.00

Mill Batch

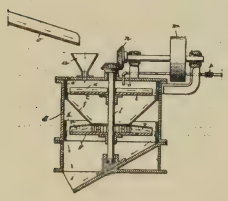
Frit	100.0
Clay	4.0
Tin oxide	4.0
Water	45.0

H. F. S.

Recommended specifications for ceramic whiting. ANON. Bur. Stand., *Circ.* **152.** —This is the 5th of a series of specifs. for the kinds of lime required by different chem. industries. The preceding 4 dealt, respectively, with lime used in cooking rags, in causticizing and in the manuf. of sulphite pulp and glass. This deals with lime used in making glazes, enamels, and similar ceramic products. Ceramic whiting is really calcium carbonate, with or without a small amount of magnesium carbonate, but it performs the function of lime. It should contain not less than 97% of carbonates, and should be very fine, so that 98% of it will pass a No. 200 screen. H. F. S.

PATENT

Method and apparatus for granulating liquid slag. EMIL OPDERBECK. U. S. 1,483,241, Feb. 12, 1924. Method for granulating liquid slag, consisting in feeding the liquid slag onto a centrifugally operating expelling element, capable of impelling the slag against an abutment, and in supplying water onto said element in quantities limited by the amount which the heat supplied by the slag is capable of converting into steam, to cause the granulation of the slag into dry slag sand.



Glass

The production of colorless glass in tank furnaces. A. COUSEN AND W. E. S. TURNER. *Glass Worker,* **43** [19], 15(1924).—Meeting of the Soc. of Glass Tech., Jan. 16, 1924. Glasses containing arsenic and decolorized with selenium turn yellow when exposed to sunlight while glasses originally yellow, due to selenium without arsenic, become bleached by sunlight. Yellow selenium glasses reheated to 500° to 600°C become deeper in color. When pink selenium glasses containing arsenious oxide or sodium nitrate are reheated to 500° to 600°C a loss of color occurs. R. J. M.

The new Edward Ford plate glass plant. HENRY W. HESS. *Glass Worker,* **43** [23], 11 (1924).—The plant has 16 furnaces of 20 pots each. Grinding machines by Hooven, Owens, Rentschler Co., casting tables by Rosedale Foundry & Mach. Co., leer by J. W. Cruikshank Eng. Co., Morgan gas producers, coal handling equipment by

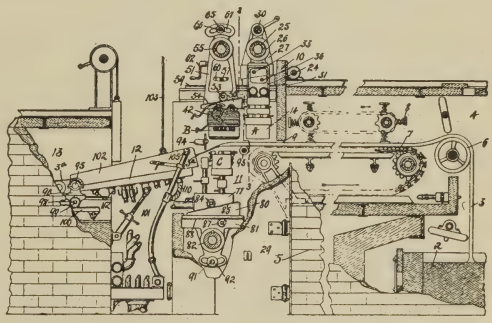
R. H. Beaumont Co., a Proctor and Schwartz drier for pots and Babcock & Wilcox Co. boilers. R. J. M.

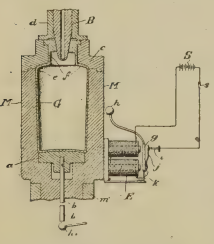
The use of selenium as a decolorizer. R. R. SHIVELY. *Glass Indus.*, **5**, 26–7 (1924).—As a decolorizer $^1/_8$ to 1 oz. Se per 1000 lbs. sand is required. A neutral fire should be maintained in tanks when Se is used. The hotter the tank the less Se is required. Not more than 42 lbs. soda ash per 100 sand should be used in the batch or a dark coloration occurs with Se. D. E. S.

The Department of Glass Technology, Sheffield, England. W. E. S. TURNER. *Glass Indus.*, **5**, 39–40(1924). D. E. S.

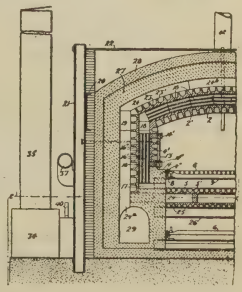
PATENTS

Method and apparatus for forming glass. ROBERT M. CORL. U. S. 1,483,336, Feb. 12, 1924. The method of forming sheet glass, which consists of continuously drawing a thick mass of glass in sheet form from a molten source of supply, the sheet mass being drawn in a plane at an upward angle to the surface of the molten mass, and, while conveying the sheet mass away from the drawing source and maintaining heat therein, applying a converting heat to the sheet mass to continuously flow a sheet of predetermined thickness therefrom and then conveying the thinned sheet through a gradually reducing temperature. The combination with a furnace of the class described from which a column of metal feeds, of a shaft extending transversely of the column and to one side thereof, and a heater carried by said shaft for adjustment lengthwise thereof to place it in operative or inoperative relation to said column. The combination with a furnace from which a sheet of glass continuously passes, of a substantially horizontal table for supporting said sheet at a predetermined distance from the furnace as it passes therefrom, the delivery end of said table being pivoted and the receiving end thereof being mounted for vertical swinging adjustment to vary the point of contact of the sheet therewith, the table having its sheet contacting surface corrugated, and means for tiltingly adjusting the table. (Cf. *Ceram. Abs.*, **3** [2], 40 (1924).)





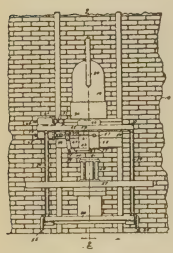
Method of molding glassware. JOHN A. MILLIKEN. U. S. 1,482,760, Feb. 5, 1924. The method of molding glassware, which comprises introducing molten glass into a mold and causing it to take the form of the mold, and simultaneously applying to the mold a succession of blows. The method of producing a smooth finish on glassware, which comprises introducing molten glass into a mold, and vibrating the mold while the glass is in a plastic condition.



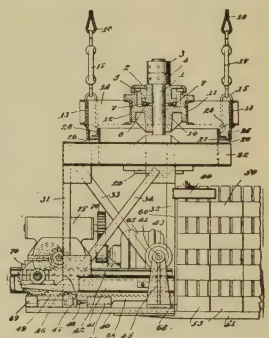
Annealing leer or furnace. ROBERT D. PIKE. U. S. 1,486,265, Mar. 11, 1924. A glass annealing leer comprising a muffle, enclosed passageways formed in the walls of he muffle and communicating with the interior thereof,

said passageways being so arranged as to receive heat transmitted from the walls of the muffle so as to cause convection currents to be circulated over the articles within the muffle.

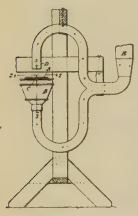
Method of and apparatus for feeding molten glass into molds. ALEXANDER L. SCHRAM. U. S. 1,484,907, Feb. 26, 1924. The method of gathering glass from a flowing stream, which consists in establishing a regulated flowing stream of glass, simultaneously severing and enlarging the stream below the outlet at intervals, utilizing the enlarged severed end of the stream as a moving plastic support for the on-coming stream of glass and a portion of the gathered mass, bodily arresting the downward movement of the accumulated mass until a sufficient quantity to make the desired article has been accumulated, simultaneously releasing the accumulated mass on its bottom and shearing the stream above the accumulated mass, and lastly releasing the accumulated mass on its sides.



Bricksetting machine. GRAFTON E. LUCE. U. S. 1,487,688, Mar. 18, 1924. Brick handling app. of the kind described, consisting in means to engage and lift a stack of brick, including means to contact with substantially the central portion of the foundation rows of brick in the stack, said brick engaging means having mechanism adapted to move the same under the brick while the carrier is stationary for loading the brick stack onto the carrier, said brick engaging means being movable rearwardly to release the brick stack for unloading.

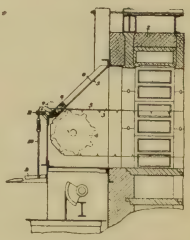


Sealing metal to glass. NAAMLOOZE VENOOTSCHAP PHILLIPS GLOEILAMPENFABRIEKEN (Eindhoven, Holland). Brit. 202,941, Oct. 25, 1922. For sealing leading-in wires, etc., a ring or cap of chromium iron alloy is used, having an expansion coeff. approx. that of glass. Various uses are indicated. Lead-in wires may be welded to the metal, which seals easily to glass. W. M. C.



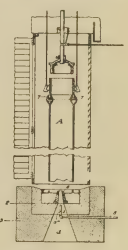
Heat treatment of glass articles. JESSE T. LITTLETON, JR. U. S. 1,483,461, Feb. 12, 1924. The hereinbefore described method of heat treatment of pressed glass articles to increase their thermal and mechanical endurance which consists in heating the article after pressing to equalize the temperature of different parts thereof, and in then rapidly uniformly cooling the article from a substantially uniform temperature above the annealing temperature of the glass of which it is composed by high velocity air jets directed on substantially the entire surface of the article.

Process of and mixture for making glass. ALEXANDER L. DUVAL D'ADRIAN. U. S. 1,482,389, Feb. 19, 1924. A glass-forming mixture containing iron and a chlorine compound adapted to act as an oxidizing agent.

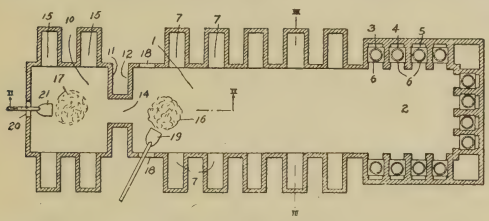


Charging doors for leers. EDWIN E. MILNER. U. S. 1,484,521, Feb. 19, 1914. An annealing leer having a charging opening, inclined frame members arranged across such opening and spaced transversely from each other, a charging door pivotally mounted between each pair of said frame members and arranged to close upwardly and outwardly against said members, each of said doors having a counterweight substantially balancing the door but arranged to normally hold it in closed position, together with separate actuating means for opening each of doors, substantially as described.

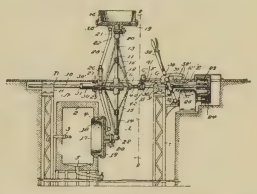
Manufacture of glass cylinders. CLYDE S. ROBB. U. S. 1,484,339, Feb. 19, 1924. In apparatus for drawing glass cylinders, a batch containing vessel, a conduit extending upwardly therethrough opening directly within the formative zone of the article being drawn and in open communication with the atmosphere below, and an air supply pipe leading to but spaced away from said conduit to supply air upwardly through the conduit while allowing for return flow of excess air backwardly through said conduit and around said pipe.



Borosilicic acid glass. KITSUZO-FUWA AND TOKYO DENKI KABUSHIKI KAISHA. Japn. 42,161, Mar. 31, 1922. The glass contains SiO_2 66.0–67.5, Al_2O_3 1.0–1.75, Na_2O 7.0–8.0, and B_2O_3 22.0–24.0%. It resists sudden change of temp., *e. g.*, it can be heated to 290° and dipped into H_2O at 23° without cracking. It adheres to W-wire and is resistant to efflorescence. It is easily worked with an ordinary coal-gas burner. (*C. A.*)

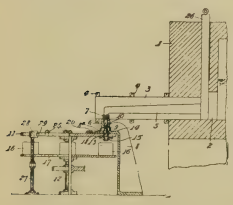


Glass-melting tank. HARRY G. SLINGLUFF. U. S. 1,486,992, Mar. 18, 1924. The combination with a regenerative glass melting tank having a melting end and a discharge end of means for supplying molten glass to said melting end of the tank. The process of operating a regenerative glass melting furnace which consists in supplying batch to the melting end of such furnace and also feeding molten glass into such melting end to the rear of said batch.



Glass-drawing device. WILLIAM WESTBURY. U. S. 1,484,101, Feb. 19, 1924. The combination of a heating kiln having an opening in a vertical wall thereof, a carrier rotatable on a horizontal axis, means for rotating said carrier, pots tiltably mounted on the carrier, eccentric mechanism operative on the rotation of the carrier for reversely tilting the pots between vertical and horizontal positions, and means for sliding the carrier back and forth to move a vertically disposed pot into and out of the kiln opening.

Automatic flow for glass tanks. WILLIAM H. MCSWAIN and HARRY W. MCSWAIN. U. S. 1,484,952, Feb. 26, 1924. An automatic flow for glass, comprising, in combination with a glass tank, a spout leading from the tank, a horizontal stand located beneath said spout and having a vertical passage therethrough, means for conducting glass from said spout to said passage, a rotating table having the edge portion thereof in closely underlying relation to said stand and having oblong openings in said edge portion, said openings being located to be successively carried by rotation of the table into register with said passage for receiving glass from the latter, a shear, means for actuating said shear across the lower end of said passage at a definite point in the registration of each table-opening with said passage, a second table located beneath the first table and molds carried by the second table in position to receive charges of glass detached by said shear.



Glass furnace. SADAJIRÔ KÔNO. Japn. 41,629, Jan. 31, 1922. Addn. to 35,150. A small furnace fixed to the main one for holding clear melted glass has a delivery orifice in the bottom, in which a rod rests. By the piston-like motion of the rod, a definite

quantity of melted glass is pushed away from the orifice, and is received in a mold of a suitable form.

Glass. TOSAKU YOSHIOKA. Japn. 41,227, Dec. 22, 1921. Addn. to 40,242 (*Ceram. Abs.*, **2** [7], 155 (1922)). Superheated steam is passed into a mixt. of 100 parts of SiO_2, 22 parts of limestone, and 33 parts of NaCl, heated in a revolving furnace at about 700°. The NaCl is decompd., producing HCl gas, and the SiO_2 is changed into Na salt. Then the mixt. is heated more highly and melted to glass. The mixt. is liable to become powdery and prevents the passing of steam; this difficulty is removed by mixing 2–3% CaO paste with the original mixt.

Etching glass. NAAMLOOZE VENOOTSCHAP PHILLIPS GLOEILAMPENFABRIEKEN. Brit. 189,763, Nov. 8, 1922. A process for producing transparent markings on frosted glass, such as trade marks on lamp bulbs, consists in printing or stamping the required design on the glass in an acid-resist and then etching the glass. The resist may be composed of "Lanoline," beeswax and resin with or without resin-oil and horse-fat, and is preferably applied to the glass in a fused state.

Heavy Clay Products

Construction features of importance to clay plants. T. W. GARVE. *The Clayworker*, **80**, 442–5(1923).—See *Jour. Amer. Ceram. Soc.*, **6**, 961–71(1923). J. W. H.

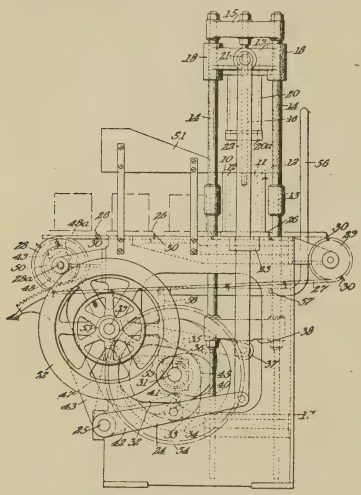
A new French system of brick manufacture. ANON. *Brit. Clayworker*, **32**, 256–60(1923).—Dry press brick plants at Charleroi, Belgium and Lens, France, using a patented "humidicator" are described. The apparatus is designed for adding a small measured percentage of water to clay which has been previously dried and ground to a fine powder. It comprises three shallow pans, one above the other, fixed to the frame of the machine. Each pan is provided with a number of steel blades fixed to arms keyed on a central vertical rotating spindle, and so disposed as to thoroughly churn the powdered clay in order to expose every part of it to the finely atomized water blown downward upon it from a number of fine jets. The water passing by gravity from a graduated tank or container, meets at the jets with a blast of air under pressure and is blown as an invisible spray on the ground clay in the top pan. A stream of the clay is delivered, at a measured rate, into the top pan near its center. The revolving blades gradually pass the clay from the center to the periphery where openings are provided to allow it to fall into a second pan. A similar set of blades, revolving on the same vertical spindle, churn the clay in the second pan and at the same time pass it to the center. It then falls through openings in the third pan, which is provided with a third set of blades. These repeated churnings effect a uniform mixture of the moisture with the clay. The methods of mining, grinding and screening at Lens are of interest. The clay used at this plant is a sandy loam only 4′ in thickness. It is excavated with a Bondy surface excavator by means of which the clay is delivered from the clay bank by an arm fitted with a conveyor into wagons running on rails. After passing through rolls the clay is run through a drying tube. This machine is 49′ long and 5′ 9″ diam. and is encased in brickwork except where the two carrying rings and the driving gear ring occurs. The carrying rings or trunions allow a smooth turning movement. A furnace built at the end where the clay enters provides the heat for drying. The hot gases go with the clay from the hot end to the dry end and are exhausted into a chimney by an induced draft fan. At the dry end the clay, still warm, passes directly into a large ball mill and is ground to a size of about 30 mesh. The ball mill screens the clay to the required fineness and it is conveyed by belt conveyors to two humidicators, each of which serves three presses. The hydraulic presses have gages attached to them which show a pressure of 110 tons for two bricks. H. G. S.

Proposed specifications for roofing tile. ANON. *Tonind. Ztg.*, **48**, 101–2(1924).—Roofing tile should be true in shape, having a good ring and a pure color. They should show no efflorescence or flashing. *Body.*—The body should show a uniform fracture without laminations. It should be free from lime and pyrite nodules. *Shape.*—The principle shapes are flat tile, grooved tile and plate tile besides the ridge tile. The standard dimensions for flat, plate and ridge tile are given in specifications in *Tonind. Ztg.*, **40** (1920). The sizes for grooved tile have not yet been specified. *Weight.*—The weight of normal flat tile should not be over $1^1/_4$ kgs.; that for plate tile not over 2 kgs.; and that of grooved tile not over 2.9 kgs. *Absorption.*—The average absorption of 10 tile is detd. These are thoroughly dried and then boiled in water to constant wt. The increase in weight for vitrified tile should not be over 6% and that for porous tile not over 17%. These should be designated as clay and loam tile, respectively. *Permeability.*—The permeability of tile to water is detd. in the following manner: A round piece is broken from the tile having a diam. of approx. 2 cms. larger than that of the glass cylinder which is 3.5 cms. In diam. (= 9.7 sq. cms.). The tile is trimmed with pinchers down to nearly the proper size and then is ground in a conical shape on the grind stone. The diam. of the lower portion of the test piece should be equal to that of the glass cylinder while the diam. of the upper portion should be larger than that of the glass cylinder. The glass cylinder is then cemented to the upper portion of the tile with a cement. The cement and conical sides of the tile are painted with a lacquer making them impervious to water. The glass cylinder is filled to a height of 15 cms. It is allowed to stand one hr. If drops penetrate through the tile it is considered pervious to water. *Cross breaking strength.*—The tile are placed on supports 30 cms. apart and a load is applied in the center. Standard tile must have a strength of not less than 100 kgs./cm.^{2} when dry, not less than 90 kgs./cm.^{2} when wet and not less than 80 kgs./cm.^{2} when subjected to 10 freezing treatments. The formula $3Pl/2bh^2$ is used in calculating the cross-breaking strength. *Resistance to frost.*—Roofing tile of all kinds must be resistant to frost. The tile to be tested are placed in water and frozen to —15°C for 14 hrs. and are thawed out at 20°C. This is done 25 times. The tile show no signs of disintegration. The same test is used for colored, glazed and engobe tile. *Glaze.*—The glaze should be well united with the body. Craze cracks on the glaze are permissible. The glaze should not peel from the body after long periods of time. The same specifs. apply to engobed tile. *Hardness.*—The body should have a hardness of 5 and the glazes of 7. H. G. S.

Firing with producer gas. C. F. SMITH. *Brick & Clay Record*, **63**, 770–1(1923).—Author gives excellent hints on opern. of a gas producer fired continuous chamber kiln for burning brick. Chambers are 49 ft. long, 14 ft. wide and 9 ft. high. Chambers are burned off at the rate of one every 24 hrs. For best practice the kiln should have at least 13 chambers. Coal consumption is 800 lb. per thousand g. in brick. Slack coal is the cheapest fuel but unless the producers are especially designed for its use, it cannot be used. Nut, run of mine and lump coal are satisfactory. The nut gives best results but on the other hand is hard to get. When run of mine or lump is used, the large lumps should be broken, while run of mine containing much slack should be avoided. The principal requirement of a coal for producer's work is that it be high in volatile matter. The ideal coal is one that gives off its volatile matter slowly, keeping up a steady supply from this source while the CO is coming from the fixed carbon. Th surface of the fuel bed must be watched for holes or bright spots which show that the air is channeling. Producer gas made in the type of producer generally used will deposit tar at temp. below 800°F. These temp. refer to gas as it leaves the producer. The neutral zone is between 800° and 900°F. J. W. H.

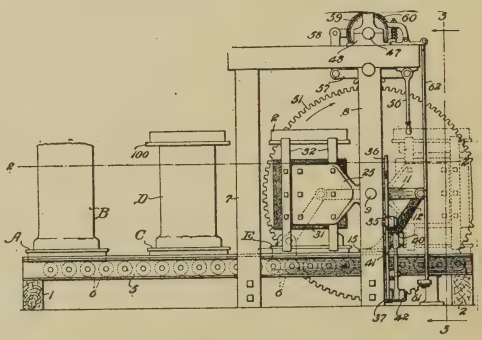
Oil firing clay products. (III-IV.) W. D. RICHARDSON. *The Clayworker*, **80**,

458–59; 552–53 (1923).—A moderate sized plant should have storage capacity for 50,000 gal. of oil, while a large plant for 100,000 gal. or more. Strainers for removal of foreign matter held in suspension should be placed (1) before entering storage tank, (2) on suction line between storage tank and pump, (3) between pump and heater, (4) finest strainer between heater and burners. Moreover the strainers should be in duplicate and in parallel, so that one may always be clean. Oil is usually heated by steam to permit of flowing. Very little steam is required as sp. ht. of fuel oil is but one-half of that of water. Oil is generally heated between 150° and 180°F. Unless oil is heated to a temp. approaching its flash point before admission to burners, the atomization is apt to be incomplete. Fluctuating oil temp. will cause flame to be unsteady. Long oil lines from storage tanks are kept warm by running the steam lines parallel in same trench or conduit. Oil pumps are of low or high pressure, electric or steam driven, of the piston or centrifugal type. Use of air (for atomization) above 5 lb. involves use of piston driven compressors, which are objectionable on account of high cost of installation and opern. Hence tendency is to use low pressures. Cuts of various pumps, strainers and blowers accompany the articles. J. W. H.

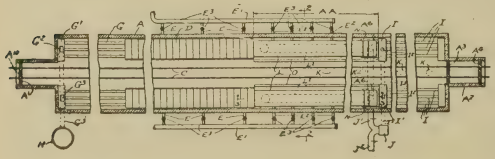


PATENTS

Tile-making machine. MORRIS KATCHER and ROWLAND MCWILLIAMS. U. S. 1,483,513, Feb. 12, 1924. In a machine for making hollow tile, the combination of two mold elements defining a vertical interspace for receiving the material to be molded, a ram having a cross-sectional configuration corresponding to the interspace, a support below the mold elements, mechanism for cyclically moving the mold elements, the ram and the support relatively to each other to compress material in the molded block upon the support, manually operable control means for setting the mechanism into motion and means for automatically stopping the mechanism at the end of a cycle of operation.



Clay-pipe-handling device. GEORGE W. GANG. U. S. 1,486,877, Mar. 18, 1924. In a machine for turning pipe sections, a rotatable shaft, a pair of cradle members keyed to said shaft and slidable thereon and means for rotating said shaft.



Method of and apparatus for flashing brick. CONRAD DRESSLER. U. S. 1,486,129, Mar. 11, 1924. The method of flashing brick in a

continuous muffle heated kiln which consists in passing fuel and air for its partial combustion into a high temperature portion of the kiln chamber to thereby maintain a reducing gas atmosphere in said kiln chamber portion and in the portion of the cooling zone of the kiln in which the brick are at a temperature high enough to result in surface oxidation if exposed to an oxidizing atmosphere.

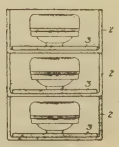
Refractories

Research on refractories in France. V. Bodin. *Ceramique,* **26,** 200–6(1923).—The following investigation was conducted in the laboratory of the Refractories Association of France. 12 silica, 7 quartzite, 5 fire clay, 10 highly aluminous, and 4 bauxite brick were tested. The chem. analyses, the permanent expans. and contraction, the reversible expans. and contraction and the softening points were determined. According to B. a good fire-clay brick with 30% Al_2O_3 withstands 1600°C for 2 hrs. without deformation; good silica and highly aluminous brick withstand a similar test at 1700°C; the linear change of a good quartzite brick should be less than 1–1½%, after heating to 1500°C for 3 hrs.; the shrinkage of a good fire-clay brick should not be over 1.5% after heating to 1600°C for 2 hrs.; highly aluminous brick should show a linear change of less than 1% when heated to 1600°C and less than 2% when fired to 1700°C. The reversible expansion tests showed only small differences in the brick and seemed to be dependent chiefly upon the chem. compns. It is largest with silica brick. Strength tests conducted on 2 cm. cubes showed maximum and minimum points when tested between 700° and 1500°C in each case with the exception of magnesite and chrome brick. The resistance of refractories to load was conducted on 2-cm. cylinders 5 to 6 cms. high. The effect of sudden temp. changes was measured on 6-cm. cubes. These were heated 1000°C and chilled in water. They were then heated to 1200°C and cooled by blowing cold air upon them. This treatment was repeated until the brick could be broken with the hands. This study showed that carborundum brick were most resistant to spalling. Brick containing carborundum and highly aluminous brick ranked next in their resistance to spalling. The brick least resistant to spalling were those containing coarse particles of silica and silica brick. H. G. S.

Brick and block making plant for the Kailan Mining Administration, China. Anon. *Iron and Coal Trades Rev.* (London), **108** [2], 916(1924).—An article with plan drawings describes a plant recently supplied by Messrs. Wm. Johnson & Sons, Ltd. (Leeds), to the Kailan Mining Administration, China, for making stiff-mud, fire and silica brick. Complete description of special and regular machy., processes, capacities, and burning is given. The installation includes mchy. for production of furnace blocks up to 14 in. sq., liners, hex. stove bricks, socketted sewer pipe, etc. R. D. L.

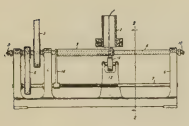
PATENTS

Artificial magnesia spinel and process of manufacture. Frank J. Tone. U. S. 1,448,010, May 22, 1923. The process of making magnesia spinel, which consists in electrically smelting a mixt. contg. magnesia and alumina and a reducing agent at a temp. sufficient to fuse the ores and reduce a portion of the impurities in the ores to metallic form, allowing the fused product to cool, and separating the metallic impurities.



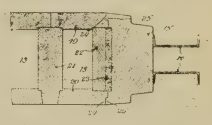
Sagger structure. Frank J. Tone. U. S. 1,448,011, May 22, 1923. In sagger construction, a refractory structural supporting member, containing a material other and stronger than sagger material.

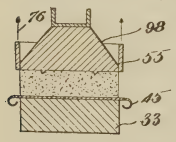
Quartz working. Edward R. Berry. U. S. 1,482,455, Feb. 5, 1924. A quartz working apparatus comprising the combination of a rotatable form or mandrel, means for delivering thereto a strip of plastic quartz, means for rotating said mandrel while feeding



the same longitudinally, means for applying heat to quartz strip coiled upon said mandrel and means for applying pressure externally upon the coils of said strip to cause coalescence thereof.

Coke-oven wall structure. JOSEPH VAN ACKEREN. U. S. 1,486,401, Mar. 11, 1924. In a coke oven structure, in combination: a heating wall comprising spaced silica liner-brick sections connected together at intervals by silica tie-brick sections to form flame flues within said heating wall, the ends of said liner-brick sections being formed with jogged edges; a clay jamb-brick section positioned at the end of the heating wall and provided with companion jogged edges for engagement with the aforesaid jogged edges of the liner-brick section; and a substantially co-extending vertical joint interposed between said jamb-brick section and the adjacent tie-brick section of the heating wall, said joint composed of silica sand, to accommodate heterogeneous expansion or contraction of the jamb-brick section and the heating wall; substantially as specified.





Process of making refractory shapes. CHARLES LADD NORTON. U. S. 1,484,735, Feb. 26, 1924. That process of making molded shapes from granular material which comprises molding such a shape upon a pallet plate by forcibly projecting, as by dropping, an unrestrained mass of such material in the form of a dense swarm of discrete particles into a mold-box resting upon such plate, and removing the mold-box to leave the molded shape upon said plate.

Reflocculated product and process of preparing same. EDWARD G. ACHESON. U. S. 1,456,112, May 22, 1923. The herein described novel product prepared by subjecting a solid material susceptible of deflocculation to attrition in presence of an organic deflocculating agent and thereafter reflocculating the colloidal material in presence of the residual fine material, said product comprising an intimate mixture of non-deflocculated and reflocculated particles.

Flux or solvent for use in technical process. ALBERT ANDREW KELLY. U. S. 1,455,791, May 22, 1923. A vitreous material comprising sodium decaborate as a constituent therein.

Manufacture of refractory products from dolomite. CHARLES ARTHUR LONGBOTTOM and FREDERICK LINDLEY DUFFIELD. U. S. 1,463,399, July 31, 1923. The herein-described process for the manuf. of refractory products from dolomite which consists in artificially mixing binding mats. with the raw dolomite, shaping the products from the mixt., subjecting them to an intense shrinking heat, and finally dipping them in a medium having sealing properties.

Refractory article and method of making the same. CLARENCE J. BROCKBANK. U. S. 1,483,507, Feb. 12, 1924. A dense hard refractory graphitic article of manufacture having a body bond and a continuous glaze of non-ceramic material and of the same coefficient of expansion and other physical characteristics.

Basic refractory and process of making same. ALBERT P. MEYER. U. S. 1,483,468, Feb. 12, 1924. As a new basic refractory, an aggregation of hard, dense, angular individually fired granules of uniform nature and standardized composition, such granules being composed of a basic magnesian refractory containing enough intimately distributed fluxing material to permit bonding at open-hearth furnace temperatures.

Basic refractory and process of making same. ALBERT P. MEYER. U. S. 1,483,469, Feb. 12, 1924. As a new basic refractory for open-hearth furnaces, a granular aggregation of sharp edged, flat faced, hard, dense individually fired granules of a mixture of dolomite and bonding agent, the several granules being of uniform composition

and the amount of bonding agent being sufficient to permit bonding of the granules at the temperatures of an open-hearth furnace.

Bonded articles of magnesia and alumina. R. C. PURDY, M. F. BEECHER and A. A. KLEIN. Can. 229,902, Mar. 27, 1923. A refractory consisting of cryst. MgO and cryst. Al_2O_3 bonded together with $MgO.Al_2O_3$ is prepd. by mixing preshrunk MgO grains with finely divided Al_2O_3 and heating the mixt. below the fusion point of the latter to form $MgO.Al_2O_3$ sufficient to bond the mixt. together. (*C. A.*)

Refractory containers for molten metals. E. W. HALE. Can. 229,316, Mar. 6, 1923. The lining of a container for molten metals consists of bricks contg. at least 30% Cr. The oxide film formed on the surface of the lining protects the lining from corrosion. (*C. A.*)

Refractory cement. W. F. ROCHOW. Can. 229,684, Mar. 20, 1923. A compn. for refractory cement contains powd. SiO_2 rock, calcined SiO_2 and dry powd. Na_2SiO_3. (*C. A.*)

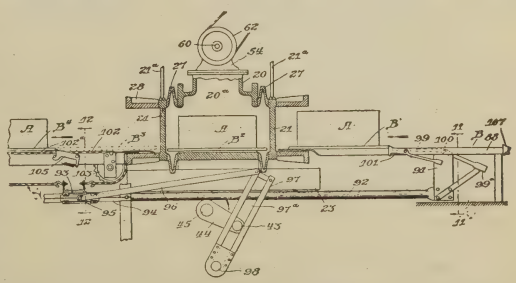
Dolomite refractories. C. A. LONGBOTTOM, F. L. DUFFIELD and W. J. REES. Brit. 191,412, July 4, 1921. Refractory products composed of dolomite are sealed against hydration after firing by immersion in molten wax, tallow, dehydrated oils or fats, or similar substances. Clay and either Fe_2O_3 or slag may be added to the dolomite in the preferred proportions of 2–10% of Fe_2O_3 and 2–15% of clay; or 2–10% each of slag and clay. The mixt. is molded into bricks and shrunk by heating to about 1500°. (*C. A.*)

Bricks and insulating stones. C. P. AASTROEM. Swed. 50,731 and 50,732, Jan. 18, 1922. A certain species of calcareous earth called "bleke" (found on the isle of Gothland in the Baltic) is passed through a fine-meshed screen, dried in the air and ground finely and then mixed with a binding substance. The latter is formed by mixing burned, finely ground "bleke" with ordinary cement. Then water is added and the mass is worked and pressed to blocks of suitable sizes and shapes, which are finally dried and hardened in the air. (Cf. 2 following abstrs.) (*C. A.*)

Insulating composition. C. P. AASTROEM. Swed. 50,733, Jan. 18, 1922. The material "bleke" (cf. above) is screened, dried and finely ground and mixed with glue water to a thick paste, which is dried and ground very finely. It is then mixed with burned, ground "bleke," clay, cement and coir. (*C. A.*)

Porous insulating material. T. A. EKLUND and C. G. LOEFVEBERG. Swed. 51,192, Mar. 8, 1922. A porous insulating material is formed by mixing "bleke" (cf. above) with cellulose. The cellulose may be partly replaced by other fibrous materials from which the incrusting substances are not removed, for instance peat fiber, peat dust, algae, straw, wood pulp, etc. (*C. A.*)

Machine for making terra-cotta blocks. MAJOR E. GATES. U. S. 1,482,646, Feb. 5, 1924. A machine for pressing plastic material into molds comprising a chamber having openings at opposite sides thereof, doors movable to close said openings, a valve for admitting a combustible mixture to said chamber, means for igniting said mixture after said doors and valve are closed, means for inserting molds into the chamber through one of said openings and means for withdrawing molds from the chamber through the other openings.



Rough-surfaced architectural pottery. ICHIRO YOKOI. Japn. 43,328, Aug. 23,

1922. Green bodies made of feldspar, granite and bog Fe ore are put in a sagger, with small spaces between them. The sagger is then filled with powd. calcined quartz. By firing it to a temp. a little below the m. p. of the body mottled wares with rough surface are obtained.

Roofing-tile kiln. TATSUJIRO KISHIMOTO. Japn. 43,050, July 11, 1922. A roofing-tile kiln has 3 chambers arranged so as to form an arch, the middle chamber being built over the passage between the other 2. The waste gases of the lower chambers are made to pass through the middle one.

Whitewares

Apparatus to determine the compression strength of insulators. H. HECHT. *Tonind. Ztg.*, **52**, 90–1(1924).—A small inexpensive hydraulic testing machine for measuring the compression strength of insulators is described. H. G. S.

Tube water colors. HANS WAGNER. *Farben-Ztg.*, **28**, 779–81(1923).—A review of the compn. and properties of aquarelle and tempera colors, especially of the desirable properties imparted to the colors by the colloidal action of slight variations in the compn. of the vehicles. Different pigments require sp. proportions of gum arabic in the vehicle to produce pastes that will not gelatinize, will not sep. on addn. of H_2O, nor produce streaky films on application, etc. The quantities of gum required for various pigments are tabulated. This quantity is dependent on the sp. gr. and degree of dispersion of the pigment. Products such as glycerol, glycol, and especially ox-gall, act as protective colloids thereby reducing the quantity of gum required, and improving the keeping qualities of the pastes in the tubes. F. A. W. (*C. A.*)

Apparatus and Equipment

Grate bar standardization. H. KUPPERS. *Trans. Feuerungstechnik*, **12** [8], 57 (1924).—Discusses the need of standardization among the estimated quarter of a million different types of grate bars. The German Standard Grate Bar Co. has taken as a basis the Schmidt changeable grate design and established a table of standards protected by patents. A single pair of these grate bars can be assembled so as to furnish an air space of 2, 4, 6, 8 and 10 mm. and experience has shown that these variations will take care of the efficient combustion of any fuel. F. A. W.

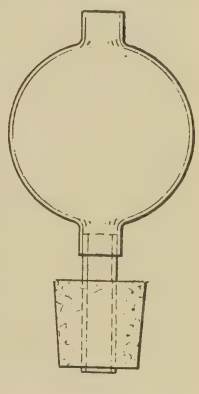
Granular carbon resistor furnaces. M. M. AUSTIN. *Ind. Eng. Chem.*, **16** [2], 156(1924).—Two types of granular carbon resistor furnaces are described, in which some disadvantages of others of this type have been overcome and the construction simplified. Method of construction and operation of both vertical and horizontal furnaces, illustrated by dimensional drawings is given. It is thought these will prove satisfactory where a cheap and efficient resistor furnace is required. R. D. L.

Furnace settings and refractory cements. F. J. WAKEM. *Ind. Eng. Chem.*, **15** [9], 893 (1923).—Chief causes for failure of furnace settings are described and remedy for each is given. Failures include plastic deformation, melting, spalling, cracking and bulging and slagging, beside the human element of poor workmanship. Special mention is made of clinkering and correct arch design. W. thinks proper selection of good refractory cements will prevent most of these troubles, if properly used. R. D. L.

Measuring viscosity. BRITISH ENGINEERING STANDARDS ASSOCIATION. *Iron and Coal Trades Rev.* (London), **108** [2], 101(1924).—The British Engineering Standards Association has issued Publication No. 188, 1923, dealing with the "British Standard Method for the Determination of Viscosity in Absolute Units," the object of which is to provide an accurate yet simple and commercially applicable method for the detn.

of viscosity of a liq. in C. G. S. units. It includes stand. dimensions for U-tube, co-axial bulb and falling sphere viscosimeters and the stand. liq. recommended for their calibration. The use and calibration of the instruments is described in detail, as well as methods for detg. viscosity of opaque liq. by means of the Lidstone Viscosimeter and by the adaptation of the tube and falling sphere viscosimeters. Copies of this publication may be obtained from the B. E. S. A., Publications Dept., 28 Victoria St., Westminster, London, S. W.1 . R. D. L.

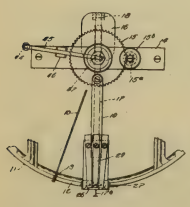
A reliable plant viscosimeter. MARTIN MARASCO. *Ind. Eng. Chem.*, **16** [2], 172 (1924).—This consists of a rubber bulb, a rubber stopper and a piece of glass tubing, assembled as shown in the sketch. The app. is dropped into the liq. to be tested and the time reqd. for submergence is a measure of viscosity. Method of calibration is given and also method for converting time in sec., using this viscosimeter, to centipoises, if it is desired to use it with different sp. gr. Advantages claimed by the author are: (1) The capillary is down in the liq. whose visc. is being measured; (2) only ordinary skill is reqd. to use it correctly; (3) it is practically unbreakable; (4) a high degree of sensitivity can be secured by selecting tubing of suitable bore; (5) it is applicable to opaque solns.; (6) it is inexpensive and easily cleaned; (7) it is always replaceable. M. states that a metal bulb and tube may be substituted, for liq. harmful to rubber. R. D. L.



Electrical precipitation of solids in stack gases. SCHROEDER. *Feuerungstechnik*, **12** [10], 73(1924).—Describes the new Oski method of electrical precipitation, the operation of which it is claimed is cheap enough to warrant consideration in the recovery of comparatively low value residues such as coal dust, etc. The apparatus is based on the theory that air in an electrical high tension field deposits its suspended solids. Instead of passing the gases between two oppositely charged electrodes as is done in most other types of electrical precipitators a wire mesh electrode of single polarity is used and a second electrode made of a semiconductor in the form of a plate and grounded is used in conjunction with it. This produces ionization and precipitation of the dust particles. A current of 40–70,000 volts and a few milliamperes is used. Advantages claimed for this system are: (1) Smallest and most uniform current consumption; (2) even current distribution through the gases; (3) remarkable high percentage of precipitation in comparison with other type apparatus; (4) cheaper installation and running expenses. F. A. W.

PATENTS

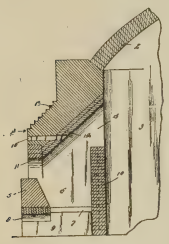
Regulator. GUY M. HAFER. U. S. 1,482,791, Feb. 5, 1924. In an elec. pyrometer for fur. a galvanometer having an oscillating needle, a pin carried by said needle, a ledge over which said pin oscillates, a member having a plurality of plungers slidably mounted therein, said plungers overlying the path of said pin, means for periodically depressing said member to cause said pin to actuate one of said plungers, an electric circuit having a switch which may be closed by one of said plungers as it is actuated, and means operable by said circuit for varying the temperature of said furnace.



Kilns, Furnaces, Fuels and Combustion

Producer practice and reaction speed. H. v. JUPTNER. *Trans. Feuerungstechnik*, **12** [7], 49(1924).—Discusses theory of combustion in gas producers and the attaining

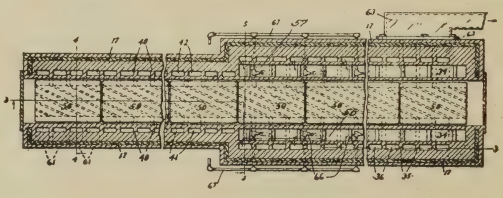
of a status of equilibrium represented by the equation $CO_2 + C \rightleftarrows 2CO$. The reaction $2CO = CO_2 + C$ takes place extremely slowly but the reverse reaction is comparatively rapid. Condition approaching equilibrium is attained in practice by increasing time of contact between the elements of combustion by (1) reducing gas velocity, (2) increasing depth of fuel bed. Speed of reaction is increased by (*a*) higher concentration of gases, (*b*) increase in temp., (*c*) use of catalytic agent. F. A. W.



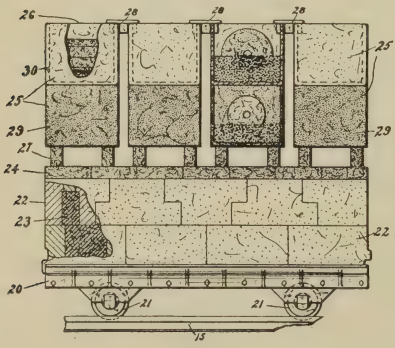
PATENTS

Kiln. Ike Bivins. U. S. 1,486,359, Mar. 11, 1924. In a kiln, a pottery chamber having a top, an inclined arch extending to a point adjacent the upper end of the pottery chamber, a front wall having an opening therein arranged below the arch, a fire box below the arch, and a vertical baffle wall arranged between the fire box and the pottery chamber and extending above the opening, the crown being provided with a horizontally arranged sight opening above the baffle wall.

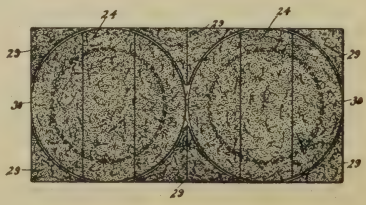
Muffle tunnel kiln. Thure Larsson. U. S. 1,485,118, Feb. 26, 1924. A tunnel kiln comprising outer walls defining a kiln chamber for conveying ware therethrough, a combustion chamber within the kiln arranged longitudinally thereof, means providing an air conduit adjacent the combustion chamber, and means for positively circulating air through said conduit to absorb heat from the combustion chamber and transfer it indirectly to the ware.



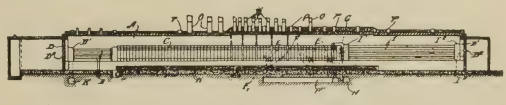
Tunnel kiln. Hugo W. H. Beth and Milton F. Beecher. U. S. 1,485,109, Feb. 26, 1924. In a tunnel kiln having longitudinal muffle benches in the heating chamber and a car traversing passage therebetween, the combination therewith of a car comprising a wheeled support, an imperforate refractory body portion thereon having a plane top disposed substantially on a level with said benches, small refractory blocks of high heat conductivity spaced on said car top so as not to obstruct the transverse flow of gases and stacks of refractory containers disposed on said blocks in spaced relation transversely and longitudinally of the car.

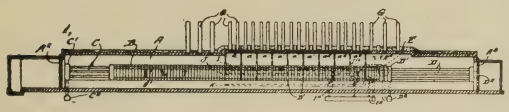


Tunnel kiln. Hugo W. H. Beth. U. S. 1,485,110, Feb. 26, 1924. A tunnel kiln comprising a movable kiln car platform, a refractory turntable mounted thereon to rotate in a horizontal plane, a plane-surfaced layer of superrefractory material on said table to support the ware, a refractory superstructure supported upon said movable platform partially surrounding said turntable at the sides to form a car body having a substantially solid top, and means for rotating the turntable while the car is within the tunnel kiln.

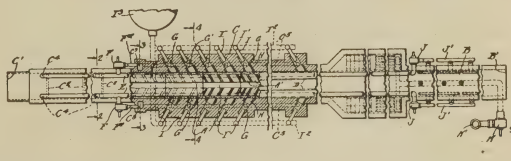


Method of and apparatus for glazing and decorating. CONRAD DRESSLER. U. S. 1,484,116, Feb. 19, 1924. In the method of firing and glazing ceramic ware of such character that gases and vapors are distilled therefrom during an initial stage of the glaze firing operation which detrimentally affect the glazing operation, if allowed to contact with the ware in a subsequent stage of the glazing operation, the improvement which consists in passing the ware continuously through an elongated kiln chamber so heated that the ware is gradually raised in temperature to the final temperature desired, restricting the flow longitudinally of the kiln chamber of the gases and vapors driven out of the ware and withdrawing said gases and vapors from the kiln chamber.





Method of and apparatus for bluing porcelain. CONRAD DRESSLER. U. S. 1,484,117, Feb. 19, 1924. In a muffle heated continuous kiln the combination with a kiln chamber and the muffle heating means therefor, of means for injecting fluid into a localized portion of the kiln chamber to make the atmosphere in that portion of the chamber either oxidizing or reducing as desired.



Continuous tunnel kiln. CONRAD DRESSLER. U. S. 1,484,118, Feb. 19, 1924. In a continuous tunnel kiln, the combination with a kiln chamber having side walls formed with burner chambers therein, of provisions for supplying air and fuel to said burner chambers, and nozzle members formed of carborundum and connecting said burner chambers to the interior of the kiln chamber.

Geology

Chinese kaolin for American potteries. ANON. *Far Eastern Rev.*, **18**, 511–4 (1922).—There are unworked deposits of good kaolin in Kwangtung and Manchuria. W. H. A. (*C. A.*)

Australian pottery clay. II. ANON. *Bull. Imp. Inst.*, **21**, 321–4(1923); cf. *ibid.*, *Imp. Inst.*, **19**, 465(1921).—Tests for the manuf. of semi-porcelain or impermeable stoneware were carried out with clay from Bendigo, Australia, contg. SiO_2 59.70, Al_2O_3 24.85, Fe_2O_3 1.45, TiO_2 nil, CaO nil, MgO 1.37, K_2O 2.30, Na_2O 1.66, loss on ignition 8.88%, in conjunction with feldspar contg. SiO_2 65.34, Al_2O_3 19.96, Fe_2O_3 0.47, TiO_2 nil, CaO nil, MgO 0.60, K_2O 7.96, Na_2O 4.44, loss on ignition 0.56%, and with massive, milky white quartz consisting of practically pure SiO_2. The results showed the clay to be quite suitable; but the working properties under industrial conditions should be detd. The compn. of the clay from this locality apparently varies considerably in different parts of the deposit. A. P.-C. (*C. A.*)

China clay. V. BODIN. *Science et industrie*, **7**, No. 108, 134–6(1923).—Comparison of English and French china clays and their respective methods of extn. and treatment. A. P.-C. (*C. A.*)

Chemistry and Physics

The preparation of artificial zeolites. PAUL EYMAEL. *Le Ciment.*, **29**, 4–6(1924).—There are a number of artificial products that have similar chem. properties to those

possessed by the natural zeolites, which are hydrous double silicates of alumina and a basic group. The indus. importance of the zeolites lies in the property that the basic group has of being easily displaced by another basic group. In water purification, by passing the water through a column of zeolite grains, the calcium in the water displaces the sodium group in the zeolite, thus softening the water. The lime in the zeolite is later removed by displacing it with a sodium group derived from a brine soln. Application has also been found in the extn. of alkalies from sugar soln., and in a number of chem. transformations. *Methods of prepn.* (*I.*) *Fused method.*—Such material as kaolin and quartz are fused with soda and feldspar, and the product leached with water. The granular residue when dried and ground to size is ready for use. "Permutit," $2SiO_2.Al_2O_3.Na_2O.+ 6H_2O$, is made in this manner. The German firm "Permutit A. G." has improved on the water washing process of the fused mass, which ordinarily breaks down some of the granules, for the alk. solns. obtained in the washing produce silicic acid by dissolving the granules, thus undermining the cohesion of the grains. This destruction has been prevented by adding silicic acid in the form of commercial sodium silicate, $1Na_2O.3–5SiO_2$, to combine with the alkali set free. *Wet methods.*—(1) The English Co. "Water Softeners Ltd." operates along the following lines: to a soln. of sodium sulphate, 2.5 kg. in 50 l. of water, are added with stirring 844 cc. of a soln. of sodium aluminate contg. 45.6 g. alumina, and 315 g. of a soln. of sodium silicate contg. 79 g. silica. The flocculent ppt. is decanted, washed with water and concd. by filter pressing. After drying and grinding the material is ready for use. (2) Another wet process is that of "The Refinite Co." A suitable clay contg. besides hydrated aluminosilicates, oxides of sodium or potassium, or their equiv. in calcium or magnesium, is made into a slip and treated with concd. sodium chloride soln. It is thus converted into an hydrated double silicate of aluminum and sodium. The mixt. is treated with excess sodium hydroxide, which dissolves free silica, sodium silicate and alumina, converts the acid double silicates into the sodium compds., and produces a fairly hard product easy to handle. After grinding the mass is crushed and dried for 48 hrs. at atmospheric temp., for 24 hr. at 100–200°, then calcined at 700°. On cooling, the product is allowed to become completely hydrated in a soln. of an alkali metal. (3) In the Brun process, a caustic soda soln. is added to a soln. of an aluminum salt, until the ppt. formed is just dissolved; then water sol. salts of sodium, as the phosphate, sulphate, chloride, are added. Finally a soln. of sodium silicate is added and the mixt. brought to a boil. The ppt. is washed, dried and calcined; it is also known as permutite. L. N.

The transverse strength of refractory clays. LARCHEVÊQUE. *Brit. Clayworker*, **32,** 293(1924).—Tests were made on bars approximately 10 in. by $^4/_6$ in. by $^1/_2$ in. supported on knife edges 8 in. apart. It was found that: (1) Fire clays, china clay, porcelain bodies, etc., all bent much more in the raw state than in the fired state. A bar which had been fired 10 times, bent less than another which had only been fired once; (2) a clay mixed with grog bends more than the same clay mixed with sand; (3) the clay which bends least when mixed with grog also bends least when mixed with other non-plastic materials; (4) the increase in transverse strength produced by mixing Nemours sand with clay is significant; and (5) the cohesion of clays examined, both in the raw and fired state, was greater with mixtures of clay and sand than with plain clay. H. G. S.

Measurement of surface tensions. ALLAN FERGUSON. Fifth Report on Colloids, etc., *Brit. Assoc. Adv. Sci.*, **1923,** 1–12.—F. stresses the importance of surface tension and reviews recent work on the detn. of (1) *contact angles*, (2) *surface tension at liquid-gas interface*, (3) *interfacial tensions*. J. A. (*C. A.*)

Some artificial barium aluminium silicates. A. S. GINZBERG. *Coll. scientific papers dedicated to F. Y. Levinson-Lessing*, Petrograd, **1915,** 34 pp.; *Mineralog. Abstracts* **2,** 153.—The system $CaAl_2Si_2O_8$–$BaAl_2Si_2O_8$ is studied. Excess of $BaAl_2Si_2O_8$

crystallizes as uniaxial, + hexagonal plates, corresponding with nephelite. Mixed crystals with up to 20% $BaAl_2Si_2O_8$ were obtained. 2V diminishes from 80° for anorthite to 68° for the 20% mixed crystals, but the optical orientation is only slightly affected. E. F. H. (*C. A.*)

The influence of hydrogen peroxide on the precipitation of zinc salts with sodium metasilicate. A. H. ERDENBRECHER. *Z. anorg. allgem. Chem.*, **131**, 119–29(1923).—The ppts. produced by Zn salts and Na_2SiO_3 in the presence of H_2O_2 contain O in amts. which vary with the concn. of H_2O_2. These substances are not definite compds. but consist of mixts. of ZnO_2 and H_2SiO_3, together with some $ZnSiO_3$. With $ZnCO_3$, peroxides with a max. O content of 12.1% are formed. The $ZnSiO_3$ once formed is not changed by H_2O_2. The H_2O_2 procedure may be used as a means of detecting ZnO_2 in the presence of $ZnSiO_3$. J. A. A. (*C. A.*)

A note on the theory of specific heats. E. CSASZAR. *Z. Physik*, **19**, 213–20 (1923).—C. summarizes the results of Debye. A new formula for the sp. heats of solid substances is derived, departing from the classical theory in that it is assumed that a crit. energy limit exists, below which the atom gives up energy discontinuously, and above which classical continuity exists. This leads to a finite series for sp. heats, instead of the infinite series of Debye's formula. Sp. heats calcd. with this formula upon Ag and Cu are compared with those calcd. by Debye's method and with exptl. results. There is good agreement. J. H. P. (*C. A.*)

Compressibility of minerals and rocks at high pressures. L. H. ADAMS AND E. D. WILLIAMSON. *J. Franklin Inst.*, **195**, 475–529(1923).—Detn. was made of the compressibility of a no. of minerals and igneous rocks under hydrostatic pressures as high as 12,000 megabars; the specimen was completely surrounded by kerosene, and subjected to pressure in a thick-walled steel bomb. The compressibility usually decreased slightly as the pressure was increased; although the change was so small for the less compressible minerals that it escaped detection. In certain expts., porous rocks were covered with a thin jacket of pure Sn to prevent the kerosene from entering the pores; in these expts., at pressures above 2000 megabars, porosity had little effect on the compressibility. The more porous rocks, however, may show an abnormally high compressibility at low pressures. Except for very low pressures, the compressibility of a holocrystalline rock may be calcd. from the known compressibilities of its constituent minerals. The compressibility usually increases with increasing basicity. Of the igneous rocks, quartz and metallic Fe are the two extremes of compressibility. In any given class of rocks, variation in compressibility at high pressures is small and due almost entirely to variation in compn., while variation at low pressures is much larger and depends chiefly on the degree of compactness. At 10,000 megabars the compressibility per megabar is approx. 1.9×10^{-6} for a typical granite and 1.2×10^{-6} for a typical gabbro. At this pressure, the rigidity of granite is 0.3×10^6 megabars, gabbro 0.5×10^6, dunite 0.6×10^6; the rigidity of the earth as a whole probably is approx. 0.9×10^6, a value higher than that of the most rigid silicate rock, this being doubtless produced by the pressure of a few hundred miles of rock on basic or ultrabasic rock. With increasing basicity, the velocity of the longitudinal vibrations, which are transmitted through the earth, increases from 5.6 km. per sec. in granite to 7.4 km. per sec. in dunite. Their initial velocity is slightly above 7 km. per sec. corresponding to a gabbro or a pyroxenite and showing the presence of basic or ultra-basic material at a comparatively small distance beneath the surface of the earth. J. S. H. (*C. A.*)

Properties of powders. The variation of pressure with the depth in columns of powders. J. H. SHARBY AND J. C. EVANS. *Trans. of Faraday Soc.*, **1923**.—Measurements of the (average) vertical pressure pa at various depths x in columns of lead shot and of powder indicate exponential increase of p with x. The absolute value of the

pressure appears to be dependent on the state of packing of the column and the resulting shape of the equal pressure surfaces; if so the observations supply grounds for inferring that a difference in packing sets in from the start, it being possible, after taking the first pressure reading to predict fairly accurately the value of the maximum pressure. The general form of the pressure-depth curve agrees well with the equation pa equals $pm(1-Ce^{-kx})$ in which pm is the maximum pressure and C and k are constants. The apparatus used was described and results are given which check closely with the calculated values. F. C. F.

PATENTS

Process of separating the constituents of mineral silicates. JOHN B. LARUE and SHERMAN W. SCOFIELD. U. S. 1,483,627, Feb. 26, 1924. In the process of converting potash-feldspar into potassium silicate and aluminate by means of converting crystalline feldspar into amorphous feldspar and heating a mixture of said amorphous feldspar and a solution of caustic potash in a closed vessel, the step of converting silicic acid into silica which consists in continuing the heating until the moisture is absorbed by the crystalline mass, resulting in a material reduction of the pressure and a material increase in the temperature.

Manufacture of chrome alum. PETER HASENCLEVER. U. S. 1,486,961, Mar. 18, 1924. The process for manufacturing chrome alum which consists in dissolving ferrochrome in a non-oxidizing mineral acid capable of dissolving ferrochrome, precipitating from the solution chromium hydroxide, the iron remaining dissolved, separating the chromium hydroxide from the liquid, dissolving the chromium hydroxide in sulphuric acid, adding potassium sulphate and crystallizing.

General

The packing of earthen ware. C. M. BONNELL, JR. *China, Glass and Lamps*, **43** [26], 11(1924).—Breakage in pottery during shipment is very often due to the method of packing. Efforts to improve packing have generally been rather unsuccessful. The U. S. Potters Assoc. granted 25% more wages to do this, but without effect. Piece work was tried, but was even worse. An example was given to show the cost of hurrying up. A large mail order house uses a conveyor system. Frequent thorough inspection has made their packing problem a minor one. They also use excelsior instead of straw. It is slower to pack, so the packers object when on a piece work wage. However, excelsior goes further than straw, which helps to reduce the ultimate price of the excelsior. Very often a few poor workmen give the rest of them a bad reputation, but the good ones do not feel that they can conscientiously report them. Figures are given showing the effect of variation in the moisture content of the staves used for barrels and indicating that proper seasoning is necessary. Wet packing material, either by sprinkling to keep down dust, or when wet after packing, is a very bad practice as the material swells and then shrinks away from the ware. F. C. F.

Electrical conductivity of solid and fused silicates. C. DOELTER. *Rec. Trav. chim.*, **42**, 720–32(1923).—A few silicates conduct at ordinary temp. Results on condy. and polarization of fused silicates are given. Electrolytic condy. is often present, even in solids. Nearly all silicates conduct at 1000°C. W. M. C.

Franco-Belgian Association for testing materials. Session of June 23, 1923. H. C. *Rev. Mat. Constr. Trav. Pub.*, **166**, 165–7(1923).—Petrographic study of refractory clays, clays for cements, and limestones, Bied and Jourdain. Clays after drying were heated slowly between 30° and 40° in a tinned iron crucible with a mixture of Canada balsam and benzene for many hours until hardened. The hard mass is then cut up into thin sections, polished and mounted on glass slides, according to the established

technique for obtaining petrographic rock sections. Clays can be grouped as follows: cryst. kaolinite and halloysite, amorphous or colloidal, allophane and collyrite.
L. N.

A new mechanical fuel feeder. ANON. *Brit. Clayworker*, **32**, 312(1924).—Illustrations are shown of a new stoking appliance for feeding coal into a Hoffmann kiln.
H. G. S.

Producer-gas and gas-producer practice. VII. R. V. WHEELER. *Fuel*, **2**, 369–72 (1923); cf. *C. A.*, **18**, 458.—The subject is concluded under the following headings: efficiency of a gas plant, gross and net calorific values, efficiency trials, radiation losses, losses due to sensible heat of the product, losses due to unburned fuel and the choice of fuel for gas producers. C. C. D. (*C. A.*)

Electric furnace types surveyed. L. W. EGAN. *Iron Age*, **112**, 1283–6(1923).—Discussion of the advantages and disadvantages of the arc, resistance, and induction furnaces for foundry use. Elec. furnaces out-class the best combustion furnace practice except in installation cost. The arc type is most rapid in action, has largest capacity per unit; the muffled arc is a large heat source at comparatively low temps.; Baily resistance furnace gives greater metal temp. uniformity; Ajax induction has low power cost and low metal cost. Induction furnaces are ideal electrothermic units, but are not suitable for steel. The resistance furnace excels with dirty charges. Melts can be made better and cheaper in resistance furnaces than in combustion furnaces.
C. L. M. (*C. A.*)

Advances in ceramics. W. FUNK. *Chem.-Ztg.*, **47**, 673–5, 701–3, 718–9, 734–6, 742–4(1923). E. J. C. (*C. A.*)

Ceramic industries in England. A. S. W. ODELBERG. *Svensk. Kem. Tids.*, **35**, 247–66(1923).—A descriptive and historical article. A. R. R. (*C. A.*)

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[1] The abbreviation (*C. A.*) at the end of an abstract indicates that the abstract was secured from the Editor of *Chemical Abstract* by coöperative agreement.

Abrasives

Corundum abrasive wheels (Transvaal). F. J. Tromp. *S. Af. Jour. Indus.*, **71**, 27(1924).—Total amt. of Transvaal corundum produced in 1922 was 2,024 T., almost the whole amt. being used for prod. of abrasive wheels. Transvaal corundum is obtained in a very pure form (from 95–98% Al_2O_3), owing to the fact that it occurs in the form of comparatively large crys. of nearly pure alumina, which can be readily separated from the accompanying gravel or enclosing rock. There seems no reason why these valuable deposits should not be the basis of an important industry, provided an export market can be obtained. The industry is discussed under various heads—grits, grades and bonds, glazing and loading, the making of a wheel, speed tests; grinding tests and railway grinding tests, with illustrations and statistics. O. P. R. O.

PATENT

Method of purifying silicon-carbide crystals. Clarence J. Brockbank 1,488,311, Mar. 25, 1924. The method of purifying silicon carbide crys. or grains that consists in treating the carbide with a solution of a metallic subs. capable of replacing the impurities with its contained metal.

Art

Deposition of metals on glass and ceramics. Samuel Wein. *Met. Indus.*, **23**, 532(1923).—There are 3 methods of depositing metals on non-conducting surfaces. *First method.*—An adhesive (gum, resin, or similar compound) is dissolved, into which are stirred such conducting elements as graphite or metallic powders, or both. This process is the cheapest. The results are quite permanent if done carefully, but with time the deposited metal has a tendency to peel. The process is readily prepd. by dissolving ordinary orange shellac in alcohol to the consistency of thin paint: to this is added graphite (free from oil and grit) or bronze powder or both; this may be applied to the surface by hand or air brush. If the designs are not too fine in detail, paper stencils may be used to advantage. This is placed away to dry (about 1 hr.), proper elec. connections made thereto, and it is ready to be copper-plated. A copper-cyanide soln. is the best for the "strike," and after a while it may be transferred to the ordinary copper-sulphate soln. *Second method.*—A metal or metallic salt is mixed with a flux, and this applied to the surface and then subjected to heat, the object being that the metallic salt is converted into the metal and at the same time fused into the surface proper. This process is by far the best, and at the same time most permanent. It is difficult to remove, once the metal is fused into the surface. In this process "metallized silver" is first made, by adding 1 part nitric acid to 6 parts of water, and one ounce of metallic silver. When the silver is all dissolved it is diluted with several times its bulk of water. Insert a piece of copper; after a time the silver will be pptd. on the copper in the form of white flakes, the silver is then collected, dried and prepd. for use. It is best powdered or ground in a mortar and pestle, or in a paint mill. The formula used by Pottier (first to use metallic silver and a flux) consisted of: silver 75 pts., lead borate 25 pts. These are ground together in a paint mill with a little essence of turpentine and oil of neat's-foot. This compd. is applied to the surface and fired in a kiln. Dimes recommends: silver 1 oz., mercuric oxide 1 dwt. The formulas in the following tables have all been tried and give good results.

Gold may be used instead of silver for deposition; dissolve it in aqua regia, 1 pt. of nitric acid to 3 pts. hydrochloric acid, great care must be taken as these fumes arising are extremely poisonous. When the gold is dissolved, gold chloride in soln. is the result. Metallized gold must be pptd. from this soln.: divide the soln. equally and pour into 4 tumblers, to each add twice its bulk of clear distilled water. Dissolve some ferrous

1

Silver chloride (fused)	1 oz.
Lead acetate	1 dwt.
Soda ash	1 dwt.
Potassium nitrate	1/4 dwt.
Boracic acid	1/4 dwt.
Borax	1/4 dwt.

2

Silver chloride (fused)	1 oz.
Lead borate	2 dwt.
Potassium nitrate	2 dwt.
Borax	1 dwt.

3

Flint glass (powdered)	6 grains
Lead oxide	6 grains
Potassium nitrate	24 grains
Borax	6 grains
Boracic acid	12 grains
Silver chloride	1 oz.

4

Silver chloride	4 oz.
Boracic acid	4 dwt.
Potassium nitrate	4 dwt.
Flint (powdered)	4 dwt.
Glass (powdered)	4 dwt.
Soda ash	4 dwt.
Lead oxide	4 dwt.
Borax (calcined)	8 dwt.

sulphate in hot water, add the green soln. until a pptn. takes place; the gold will be found on the bottom of the tumbler in the form of a brown powder, when dried and the necessary amt. of flux added, is ready for use. In pouring off the original soln. a slight residue of alloy remains. When the ppt. of gold has been completely extracted, water may be poured off and the brown powder collected and dried, when dried pass through a fine sieve or silk muslin. Due to coarseness of the metal it is difficult to secure even deposits. To overcome this coarseness, prepare a soln. of gold chloride, to this add an excess quantity of potassium hydroxide soln. A ppt. will form; on the addn. of an excess of the alkali the ppt. will immediately redissolve. To this add a soln. of mercurous nitrate until no further ppt. forms. The ppt. is sepd. from the soln. and washed, and then treated with an excess of nitric acid (to dissolve the mercurous salts formed in the ppt.), and then thoroughly washed in running water. By this method the gold is left in an exceedingly fine amorphous condition; it is dried and ready for use. The following is used to great advantage: silver chloride, 1 oz.; gold, 5 dwt.; bismuth nitrate, 40 grains; glass (powdered), 1 dwt.; borax, 18 grains. Platinum can also be used. *Third method.*—The last of the processes is accredited to Marino. This is usually done by applying two or more layers of sodium silicate (water glass). This is best done by dissolving 1 pt. of sodium silicate (sp. gr. 1.27) in 2 pts. water. This is applied as the first coat, and the second coat consists of equal pts. of sodium silicate and water. The surface is brushed over with a soln. of silver chloride 100 pts. dissolved in 140 pts. of a saturated soln. of potassium cyanide to which is added 60 pts. of ammonium fluoride. The silver chloride film is reduced to metallic silver by applying a soln. of 100 pts. hydrazine sulphate dissolved to saturation. To this is added 60 pts. sodium hydroxide or carbonate. The method of procedure is to apply the silver soln., then the reducing soln., and finally submit to friction caused by a rapidly rotating brush. The article thus treated is then ready to be deposited with copper or other metals in the usual manner.

O. P. R. O.

Apparatus for the determination of color in terms of dominant wave-length, purity and brightness. Irwin G. Priest. *J. Opt. Soc. Am.*, **8**, 173–200(1924).—Details of the design of the app. are given together with directions for its use and data on its accuracy. Tests showing that homogeneous and white brightnesses are strictly additive for the wave-lengths and purity values considered are included. D. E. S.

Luster and its measurement. H. Schulz. *Textilber.*, **5**, 25–7(1924).—The Goerz "glanzmesser" compares the normal and diffuse reflection of light from a standard

source. Polarization luster-measuring devices require adjustment to the refractive index of the material examd. The device may be used on *artificial silk, paper*, etc.
E. R. C. (*C. A.*)

Electrodeposition of antimony. J. C. Ghosh and A. N. Kappana. *J. Phys. Chem.*, **28**, 149–160(1924).—A bath suitable for plating Sb on a large scale is made up by adding Sb_2O_3 to a boiling aq. soln. of $33^1/_3$% tartaric acid to satn., filtering, and then adding 30% HCl. High c. ds. can be employed (50 milliamps. per cm.^{2}); current efficiency runs up to 97%. With oil of bergamot as addn. agent a thin adherent deposit of Sb has been obtained which could be polished to a silvery appearance. G. and K. point out that in a HCl soln. of tartar emetic or Sb tartrate Sb is deposited by the direct discharge of Sb^{+++} ion. A. C. Z. (*C. A.*)

BOOK

Houstoun, R. A.: **Light and Color.** London: Longmans, Green & Co. 179 pp. 7s. 6d. (*C. A.*)

Cement, Lime and Plaster

Exposure tests on colorless waterproofings. Bur. Stand., *Tech. Paper* **248**; *Concrete*, **24** [3], 123(1924).—See p. 191 for this abs. F. T. H.

Rubber lined ball mills in mining and cement industries. Anon. *India Rubber World*, Dec. 1, 1923; *Concrete* (Mill Sec.), **24** [3], 47(1924).—After months of practical test it was demonstrated that the innovation of the rubber lining gives results superior to any of the metal and rock linings previously used in ball mills for grinding very hard ore and gangue rock. The grade of rubber recommended is that used for the tread of automobile tires. While sufficiently hard to resist wear, it has enough resiliency to cause the steel balls or other grinding medium to rebound upon impact in such manner as to avoid disintegration of the liner surface. Also the rebounding action produces a very marked increase in pulverizing efficiency. A method of applying the rubber slabs is covered by U. S. patent No. 1,470,597. F. T. H.

What we may expect to do with aluminate cement. Henry S. Spackman. *Concrete*, **24** [3], 88–90(1924).—Aluminate cement in France sells at the mills for between $2^1/_2$ and 3 times the price of Port. cement. All the mills mfg. aluminate cement are oversold. The economies possible in proportions, labor, forms and time offset the increased cost of the cement. F. T. H.

Cementing Qualities of Calcium Aluminates. Anon. Bur. Stand., *Tech. Paper* **197**; *Concrete* (Mill Sec.), **24** [3], 46(1924).—Additional copies of this paper have been printed. It gives the data obtained from test pieces made of eight different cements of this type. The Bureau is doing further exptl. work with aluminate cements.
F. T. H.

Recommended specification for quicklime and hydrated lime for the manufacture of silica brick. Anon. Bur. Stand., *Circ.* **153.**—A brief description of the way in which lime is used in the manuf. of silica brick is followed by a general statement as to the quality of lime required. The standard of quality is set at 92%, based on the nonvolatile matter, with maximum limits of 5 and 10% carbon dioxide, depending upon whether the sample is taken at point of shipment or of destination. Complete directions for sampling and testing are included. H. F. S.

Rapid slaking of lime. J. E. Duchez. *Rev. Mat. Constr. Trav. Pub.*, **164**, 80–2; **165**, 104–7; **166**, 127–30(1923).—In slaking burned lime contg. silica and alumina just sufficient water is added to slake the lime but not enough to hydrate any silicates or aluminates. The quantity of water to be used can be calcd. from the empirical formula, per cent water by wt. $= c - 1.7(a + b)/3$, in which the chem. compn. in wt. per cent is a SiO_2, b Al_2O_3 and Fe_2O_3, c CaO and MgO. The formula is derived from the follow-

ing considerations. The compds. formed from SiO_2, Al_2O_3 and CaO in making hydraulic cements are mainly, $SiO_2.2CaO$, $SiO_2.3CaO$, $Al_2O_3.3CaO$ and free CaO. In burning lime with mol. compn. x SiO_2, y Al_2O_3, n CaO, granting that the above compds. are formed, the max. and minimum free lime left for hydration will be: (*a*) $x(SiO_2.2CaO) + y(Al_2O_3.3CaO) + [n-(2x + 3y)]CaO$; (*b*) $x(SiO_2.3CaO) + y(Al_2O_3.3CaO) + [n-3(x + y)]CaO$. As the free lime only should be hydrated, the limits for the water content are: $[n-(2x + 3y)]H_2O$ and $[n-3(x + y)]H_2O$. Converting the per cent chem. compn. of the lime into mol. ratios gives, $0.93a$ SiO_2, $0.55b$ Al_2O_3, $1c$ CaO. Substituting these values, the limits in wt. per cent are $^1/_3[c-(1.80a + 1.65b)]$ and $^1/_3c-[(2.80a + 1.65b)]$; the fraction $^1/_3$ being the ratio of water to lime used for slaking theoretically pure lime. Equalizing the factors in the max. limit gives the empirical formula. The calcd. values agree with the quantities used in practice:

Lime from— wt. per cent compn.	Tarn.	Aude.	Cantal.	Basses-Alpe
SiO_2	4.5	0.75	16.32	25.21
Al_2O_3 and Fe_2O_3	3.1	0.32	4.00	1.32
CaO and MgO	91.94	97.70	77.58	72.00
Water of hydration. wt. per cent				
Calcd. from formula	26.04	31.29	14.34	8.96
Used in practice	25	32	15	10

Lime crushers, hydration systems and storage bins are described with special reference to installations made by the author. L. N.

Calcium chloride and concrete. ANON. *Nature*, **113,** 441(1923).—Three valuable processes for improving concrete have resulted from recent scientific study; hardening after setting with a dilute soln. of silicate of soda; the addition of mechanically slacked lime to the cement; and the use of calcium chloride for "curing" and also for mixing cement. With regard to the curing of cement, concrete requires to set in a continually moist condition in order to give the best results. For this reason, therefore, curing consists in keeping it wet either by covering with water or spreading over it damp soil or earth which is moistened continually. This is an extremely costly, laborious, and tedious job in case of a long stretch of road and is often not particularly efficient. The calcium chloride treatment consists in spreading the powdered material over the road as soon as it has set at the rate of 2–2$^1/_2$ lb. per sq. yd.; its deliquescent properties keep the surface continually moist without any trouble, the net saving in cost being very considerable. Calcium chloride is beginning to find a use for mixing with the cement, in the propn. of about 3%, which results in a much quicker hardening of the concrete for given strength and a final increase in the compressive strength, although the matter in this respect is somewhat complicated because, for some unknown reason, different cements do not react to some extent. O. P. R. O.

Cement industry—Portland and Kandos (New South Wales). R. H. CAMBADGE. *Chem. Eng. aud Min. Rev.* (Melbourne), **16,** 153(1923).—The cement industry may be relied upon for 1924, as the value for 1923 was so high action has been taken toward establishment of additional cement works. O. P. R. O.

Exposure tests on colorless waterproofing mats. Bur. Stand., *Tech. Paper* **248.** D. W. KESSLER.—Tests to det. the rel. effectiveness and durability of several colorless waterproofing mats. H. F. S.

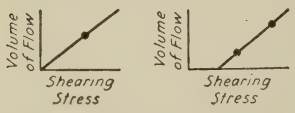
PATENT

Dampening the kiln gases before the electric precipitation of the flue dust. DALEN PORTLAND CEMENTFABRIK. Norw. 37,660, Aug. 20, 1923. The gases pass through a chamber the walls of which are sprinkled with the necessary amts. of water.

C. H. A. S. (*C. A.*)

Glass

New method of cutting glass. ANON. *The Glass Worker,* **43** [26], 15(1924).—From the *Scientific Amer.* Large sheets of glass are cut in a new machine which has two cutters for scoring the glass on both sides at identical lines. The glass comes apart with no ragged edges. No allowance for gaging is necessary. R. J. M.



On the physical properties of glass. F. ECKERT. *Jahrbuch der Radioaktivitat und Elektronik,* 20 Band Jahrg., 1923; Heft 2/3, pp. 94–275; Leipzig Verlagvon S. Hirzel, 1924.—This vol. contains nearly 200 pp. describing and discussing the phys. properties of glass. Detailed subjects, General Glass Lit.; Optical Glasses and their Optical Constants; Dispersion of Optical Glass; Absorption of Optical Glass; Absorption of Colored Glass; Effect of Absorbed Energy; Relation of Refractive Index to Composition, Pressure and Temp.; Reflection and Elliptical Polarization; Electro and Magneto Optics; Electrical and Magnetic Properties; Density and Thermal Expansion; Thermal and Molecular Properties; Elastic Properties; Behavior of Glass at High Temp. W. M. C.

The influence of light and temperature on the change of color in the production of colorless glass in tank furnaces with special reference to the use of selenium. W. E. S. TURNER and A. COUSEN. *Pottery Gaz.,* **49,** 445–49(1924).—Previous exptl. (cf. *Ceram. Abs.,* **2** [5], 94; **3** [3], 96) work had been done by the authors with regard to the effect of color of the glass of the various substances employed in batches for the production of a selenium decolorized glass. A standard batch of the compn. 100 pts. sand, 37 soda ash, and 20 lime spar was used as a basis, with variations by replacing a small propn. of the soda ash by its equiv. either of salt cake, sodium nitrate or of borax. Meltings were made in crucibles at temp. about 1370–1380°C. It was found, that by using an amt. of selenium such as normally employed in decolorizing, *viz.,* $^1/_2$ oz. per 1000 lb. of sand and keeping Fe_2O_3 content of the glass from 0.4% to 0.6% the glasses obtained in 3 hrs. melting were either decolorized or pale yellow with no certainty of color. Additions of arsenious oxide to the batch, and 3 hrs. melts under above conditions were made, which resulted in the production of glasses in which no yellow color was present. Where selenium was used in large excess, arsenious oxide contg. glasses gave a faint pink coloration. Sodium nitrate when substituted for some of the soda ash, gave glasses much deeper in color than those obtained without its use. There was no difference in appearance between borax and a simple soda lime glass. A period of $8^1/_2$ hrs. melting was then employed with following results. (1) Simple soda lime glasses, which, at the end of 3 hrs. were decolorized, or pale yellow, after $8^1/_2$ hrs. were deep yellowish brown. (2) Glasses in which a small amt. of salt cake displaced some of the soda ash, and which were decolorized after 3 hrs. or at most faintly yellow with prolonged heating became definitely green in color, the color being that due to iron oxide. (3) Arsenious oxide glasses, decolorized or practically so, after 3 hrs. were decolorized even after heating for $8^1/_2$ hrs. (4) Sodium nitrate batches became very deep brown in color when heated for the longer period. (5) Again, sodium selenite melts, which were somewhat deeper in color than those in which selenium itself was employed at the end of 3 hrs. differed little from these when long period meltings were tried. The amt. of selenium remaining in the glass was detd. and the following relationships found: (1) In all cases when salt cake was employed the amt. of selenium remaining was very small, so small as to be impossible of estn. by the method used. (2) With arsenious oxide glasses, the amt. of selenium retained was of the same order as with simple soda ash glasses. (3) With sodium nitrate batches the amt. of selenium retained was of a much larger order, and it seemed obvious that the amt. of the substance remaining in the glass was dependent upon the rate of melting of the batch, for it was clear that sodium nitrate batches melt more readily than

equiv. batches in which soda ash only is employed. It appeared in all cases so far examd. the element when in the glass did not become oxidized to selenite, but remained as selenium, its color being developed slowly as the result of continued heating. It therefore seems from the results obtained that the only stabilizing substance tried was the arsenious oxide, the salt cake tending to eliminate the selenium from the glass. Glasses were exposed to sunlight for a period of a year and two distinct results were obtained depending upon initial appearance, *i. e.*, whether deeply colored or practically free from color. The deeply colored glasses were distinctly bleached by the exposure, while the decolorized or faintly colored glasses became slightly yellow. Pink glasses obtained by use of selenium and arsenious oxide, also with selenium and sodium nitrate upon annealing became distinctly paler after 8 hrs. at 525°C, after 3 hrs. at 550°C and even at 1 hr. at 575°C. J. W. H.

The art of table and domestic glass making. F. A. PERRY. *Pottery Gaz.*, **49**, 267–73(1924).—An address bearing upon the processes in the making of glass for domestic use. J. W. H.

Simplified practice recommendation No. 10—milk and cream bottles and bottle caps. ANON. Bureau of Standards.—Representatives of the International Milk Dealers Assn., The Glass Container Assn., the Cap Mfrs. Credit Assn., and the National Assn. of Bottle Mfrs. met in a general conference at the Department of Commerce on April 26, 1923, to det. upon recognized sizes of milk bottles and milk bottle openings. The conference unanimously recommended three sizes of milk bottles for quarts, pints, and half-pints, respectively, with one size opening for the entire group. Before this constructive step milk bottles were manufd. in 12 sizes for quarts, 13 sizes for pints, 14 sizes for half-pints, 10 sizes for quarter-pints, and approx. 10 sizes of caps were required to fit this varied assortment. H. F. S.

Operating glass tanks—heat requirements of the batch-efficiency. BJARNE SCHIELDROP. *Fuels and Furnaces*, **1** [1], 43(1924).—The third of a series of articles on heat balances of glass tanks, dealing with ht. requirements and efficiencies of the batch. After batch has been introduced in the tanks, the sequence of events is assumed to be as follows: 1. Raw mats. are htd. to fur. temp. 2. Fluxes not entering into the glass, are dissociated. 3. Silicates are formed by the sand and the parts of the fluxes remaining in the bath. 4. Glass resulting from item 3 is fused. 5. Gases escaping from the batch are cooled to stack temp. 6. Glass is cooled to working temp. The amt. of ht. reqd. to melt the batch varies with the following factors: 1. Compn. of the batch mixt. 2. Temp. at which glass is withdrawn from tanks. 3. Stack temp. Using these items, a table is given showing eff. of fur. with def. wts. of raw mats. and temps. Items 5 and 6 are found from tables showing amts. of ht. given off in cooling 1 lb. of glass from 2600°F to temps. varying from 1500°F to 2400°F (working temp.) and cooling 1 lb. of gases given off from the mat., from 2600°F to temps. varying from 500°F to 1200°F (stack temp). The eff. figured is on the basis of fuel consumption given in a preceding article (Dec. 1923). The author points out that reductions in stack- and glass-withdrawal temps. result in increased eff. on account of decreased fuel consumption that overbalances the corresponding decrease in items 5 and 6. Before batch calcns. can give constructive information as an aid to design and opern., they must be available over a period covering both good and bad "runs." Well-designed and operated window glass tanks should show eff. of around 10 per cent. If below 6%, a strenuous effort should be made to det. cause. Flint or bottle glass tanks may reach 20% eff., but is commonly around 10 or 12%. A mere statement of fuel consumed per lb. of raw mat. is no indication of eff. R. D. L.

Canadian Glass Co. (new process). A. A. ICENHORN. *Indus. Canada*, **24**, 84 (1924).—The Canadian Glass Co. is to start operations shortly at Amherstburg, Ont.,

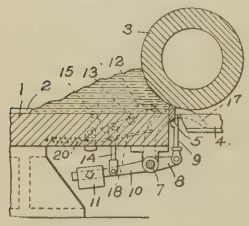
mfg. plate glass by a newly invented process, the work of A. A. I. It involves a great saving in production costs over previous methods. By it the glass will be drawn by a special machine directly from the melted batch. When drawn to the proper dimension, the plate is automatically passed to a leer, where it is annealed, and it is then ready for shipment. The rate of production is one sheet every 25 min. No grinding or polishing is necessary. The process has been tested experimentally and the company is now building a machine of commercial size at a cost of about $250,000. The factory is situated near an almost unlimited supply of silica sand. O. P. R. O.

The art of sealing base metals through glass. Wm. G. Housekeeper. *Jour. Am. Inst. Elec. Eng.*, **42,** 954–60(1923).—Four distinct methods of sealing metals to and through glass are described: (1) the flattened wire seal for small electrical conductors; (2) the ribbon seal for special purposes; (3) the disk seal for commercial manufacture of seals for carrying currents of the order of 100 amp.; (4) the tube seal, in which metal and glass tubing are joined together. The method consists in providing a large surface of contact between the glass and the metal, and in so proportioning the cross section and contour of the metal that the stresses resulting from the difference in coefficients of expansion are less than the ultimate strength of the joint between glass and metal. Since the metal (copper) is under tension, due to its greater contraction on cooling, it follows that heating of the conductor will relieve the stress, and in this way it is possible to pass sudden currents as great as 1200 amp. through a disk seal. A. F. G.

Unsplinterable glass. Anon. *Indus. Aust. and Min. Standard,* **7,** 224(1924).—A description of the processes and manuf. of the commodity known as "Triplex Safety Glass" used extensively for the wind shields of automobiles. While it is tougher than ordinary glass, it is not unbreakable, but is unsplinterable, which is its chief virtue. As a result of impact tests it was proven that while the glass was covered with innumerable cracks, no single piece was detached. France was the original home of the product, but the British product is now superior. A description of the process of mfg. is given by mentally following a piece of glass through the works. The special features of this process are the specially prepared adhesive with which the two sheets of glass are coated and the uniting of the glass sheets with a sheet of celluloid by means of hydraulic pressure. Great care and skill is required in the manuf. and expensive mats. are the only ones practical, but the many years of experiment have resulted in a product, the advantages of which are obvious. O. P. R. O.

Annealing of glass. H. V. Mallison. *Science Progress,* **18,** 473–6(1924).—Mathematical evidence is offered that glass may be annealed in 2 ways. It may be annealed quickly at a relatively high temp. and cooled slowly; or it may be annealed slowly at a relatively low temp. and cooled quickly. J. S. H. (*C. A.*)

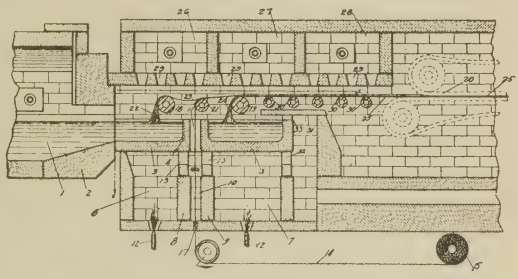
Unbreakable and malleable glass. E. Berger. *Naturwissenschaften,* **12,** 79–83 (1924).—A review dealing with the physics involved and with past attempts to produce glass highly resistant to mech. and thermal fracture. C. C. D. (*C. A.*)



PATENTS

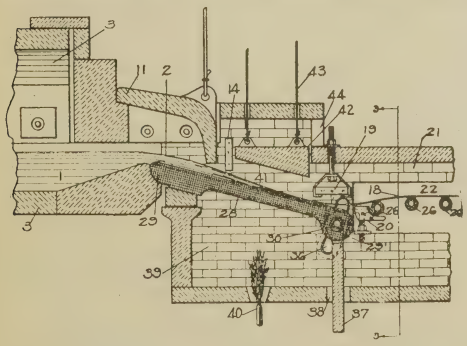
Casting table. Albert E. Evans. 1,488,911, April 1, 1924. In combination with a glass casting table, a stop member mounted for vertical movement up and down across the edge surface of the table at one end thereof, and adapted in one position to be withdrawn below the upper surface of the table, and in another position to extend above such upper surface and form a stop for the molten glass cast upon the table, a roll mounted for movement from a position directly above the stop member to the other end of the table and means for moving the member up and down.

Composition for producing glass. ALEXANDER L. DUVAL D'ADRIAN. 1,489,026, April 1, 1924. A composition for producing glass, comprising the constituents of the usual glass bath, and the natural double silicate of sodium and calcium known as pectolite.

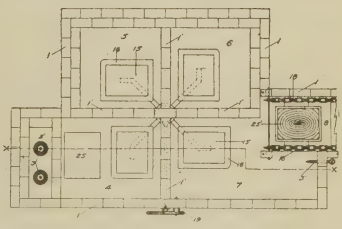


Method and apparatus for drawing wire glass. JOSEPH P. CROWLEY. 1,489,822, April 8, 1924. An apparatus for making wire-glass comprising, a receptacle containing molten glass, a pair of spaced parallel cylindrical cooled rollers mounted closely above the surface of the molten glass, means for feeding up a sheet of wire mesh at a point between the rollers, and a third roller intermediate the other two over which this wire is bent, a drawing mechanism for drawing up a mass of molten glass over each of the first rollers, and drawing a sheet horizontally from these masses, the sheet from one roller passing first over the intermediate roller and uniting with the wire, and then over the second roller and uniting with the glass drawn from the second mass of molten glass, to form a sheet of glass with the wire embedded therein, and means for directing heat against both faces of the sheet to insure the union of the several constituent parts.

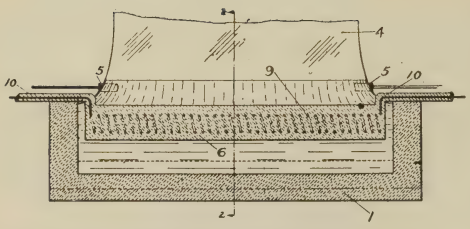
Drawing continuous sheet glass. JOSEPH P. CROWLEY. 1,489,823, April 8, 1924. An apparatus for drawing sheet glass, comprising a tank containing molten glass, a graphite drawing slab pivoted to the tank outlet so that the molten glass flows out onto the slab, a cooled supporting shaft for the free end of the slab, means for adjusting the shaft vertically to vary the inclination of the slab, a heating chamber beneath the slab, the front wall of the chamber being vertically adjustable with the slab, means for cooling the glass while on the slab, and means for stretching the glass into sheet form while on the slab.



Rotating glass-molding device. FRANK AUCREMANNE. 1,489,729, April 8, 1924. In combination with a four-chamber, glass heating furnace, of the character described, a rotating, glass-molding device, having a centrally located, stationary, base hub; a vertical journal guide, upon the upper surface of said hub; a rotating hub member, adapted to pivotally engage the guide journal of the stationary hub, and adapted to rest and rotate upon the upper surface of the stationary hub, by means of ball bearings; a plurality of carrying arms, rigidly attached to the rotating hub, and means for rotating said hub and arms, within the heating chambers, substantially as described.

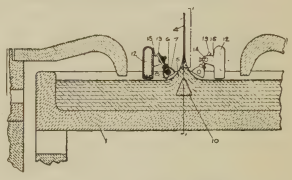


Drawing continuous sheet glass. JAMES WHITTEMORE. U. S. 1,489,875, April 8, 1924. In an apparatus for drawing sheet glass from a mass of molten glass, a

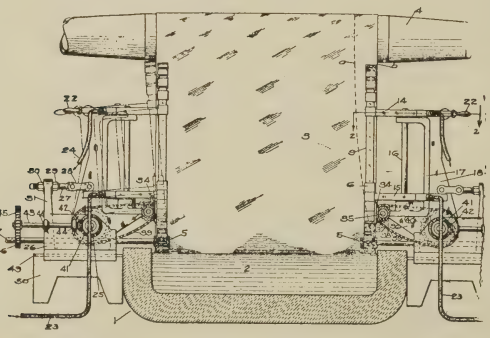


wedge-shaped member of refractory material, located within the molten mass with its edge tapering toward the line of generation of the sheet, and an electric heater enclosed within the refractory member.

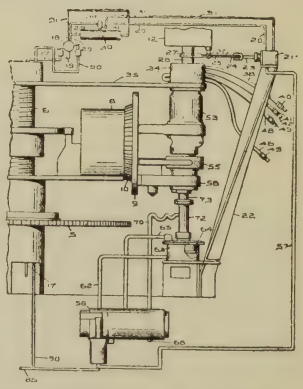
Drawing sheet glass. James Whittemore. U. S. 1,489,876, April 8, 1924. In a sheet glass drawing apparatus, a receptacle containing molten glass, means for drawing a sheet therefrom, a cooling bar submerged in the glass beneath the meniscus, and electric heaters extending across each face of the sheet near the base of the meniscus.



Drawing continuous sheet glass. Clifford A. Rowley. U. S. 1,489,852, April 8, 1924. In combination with a source of molten glass, and means for drawing a sheet of glass therefrom, a pair of guide loops, a series of grippers freely slidable on each loop, a driven sprocket for feeding the grippers around the lower arc of each loop into engagement with the sheet, an idler sprocket for enforcing uniform movement of the grippers around the upper arc of each loop, a frame yieldingly holding the loops and grippers, one against each side of an edge of the glass sheet, means for cooling the loops, a supporting base to which the frame is pivoted, and means for angularly adjusting the frame about its pivot to vary the inclination of the guide loops with respect to the line of travel of the glass sheet.



Molten-glass charge supply. Frank O'Neill. U. S. 1,490,182, April 15, 1924. Means providing a downwardly continuously flowing laterally peripherally exposed stream of molten glass, a normally open shear, means for operating the shear for severing the stream of glass into slugs, a guide in the line of the stream, therebelow and approximating in cross-sectional area the cross-sectional area of the stream, for receiving the slugs, an annular series of molds successively movable into registering position with the guide, suction means coacting through a guide registering mold, and control means for the shear and suction means for at once accelerating the slug as it is severed for travel through the guide into the mold therebelow.

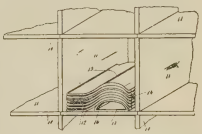


Heavy Clay Products

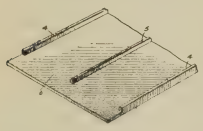
Making sewer pipe the modern way. Staff Article. *Brick and Clay Record*, **64**, 492–96(1924)—. Description of new plant of Cannelton (Ind.) Sewer Pipe Co. Numerous photos of equipment accompany the article. J. W. H.

PATENTS

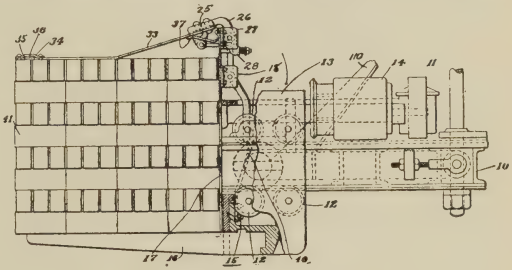
Method of and means for burning tiles. ARTHUR W. BROWN. 1,489,694, April 8, 1924. A method of burning tiles having arch portions, consisting of arranging the tiles in loose bundle-like portions in a kiln and supporting the arch portions thereof during baking of the tiles.



Brick pallet. JAMES H. MCFEELY. U. S. 1,490,119, April 15, 1924. A rolled metal pallet for use in the manufacture of bricks having a longitudinal stiffening rib along each side thereof and a longitudinal stiffening rib along the center thereof, said ribs terminating short of the pallet ends so as to provide supporting slideways.



Clamping device for brick-handling machines. GRAFTON E. LUCE. U. S. 1,490,898, April 15, 1924. In a clamping device for brick handling machines, the combination of a stationary plate, a clamp pivotally mounted thereon and extending forwardly thereof, a movable frame adapted to carry a load or pile of bricks and located beneath the clamps, and means on said frame for operating the clamping device to clamp a load or pile of bricks on the movable frame.



Refractories

The story of refractories. ANON. *Science*, **59** [1525], 275 (1924).—A motion picture film made by the Bureau of Mines is loaned free to technical societies, commercial organizations, colleges, schools and churches. Applications should be addressed to Department of the Interior, Bureau of Mines, Pittsburgh, Pa. C. J. H.

Refractories. G. M. GILL. *Colliery Guardian*, **123**, 91(1922).—The variation in size and quality of firebricks, blocks and retorts is one of the most unsatisfactory features users of refractories have to meet. To solve the difficult problems arising from varying length, width, and thickness of fire bricks, the author suggests that dimensions of retorts should be, within practical limits, the same from end to end, internally and externally; the internal dimensions affect the discharging operations, the external dimensions affect the building of the settings, much cutting of bricks and blocks being necessary where the retort is of bad shape. What appears to the author as necessary in the conduct of firebrick works is the institution of methods providing for: (1) The continuous sampling and analyses of mixts. in use, both chem. and phys. (2) The use of heat recorders in kilns. (3) Definite limiting standards for size and shape. (4) Guaranteed working to specif. The control proposed would doubtless effect the production of a higher and a more consistent quality of brick. Control would further diminish rejected bricks, save fuel costs in kilns, increase capacity of plant and effect improvements which would entail from increased knowledge of the process.

O. P. R. O.

Silica brick works of the Consett Iron Co. ANON. *Colliery Guardian*, **126**, 1163 (1923).—A detailed description of this plant for manuf. of silica bricks and shapes for the construction of the new installation of Willputte coke ovens now being erected at Consett. The raw material—ganister—is mainly composed of silica in the form of quartz with a density of 2.650. The "Consett" silica shapes contain about 30 per cent tridymite and never more than a trace of unconverted quartz; hence this practically com-

plete conversion guarantees absence of either permanent or after expansion. The article has illustrations of the works and details of construction. O. P. R. O.

Silica bricks in coke oven construction. J. ENZENAUER. *Colliery Guardian,* **121,** 565(1921).—Two batteries of ovens built, the one in 1915 of silica bricks (SiO_2 95%, CaO 2%) and the other one year later of ordinary coke oven siliceous bricks (SiO_2 80%, Al_2O_3 16%), are described by E. in Glückauf. The higher thermal conductivity of the silica brick was recorded in a shorter coking period, 24 hrs. as against 29 hrs. in the latter battery. In spite of the initially unpromising texture and brittleness of the silica brick walls, they are now in the better condition of the two. The siliceous bricks are more extensively corroded by salt and more worn by erosion. The walls of silica brick are less susceptible to fusion or deformation due to unskilled attention. The yield of by-products may possibly be adversely influenced in the silica brick construction, but this does not outweigh the advantages of increased output of good coke and of gas. The fact that higher temp. may be maintained in flues of silica brick without damage to the walls may be a temptation to shorten the coking period at the expense of by-products, but the rise in heat consumption finally renders such practice uneconomical. O. P. R. O.

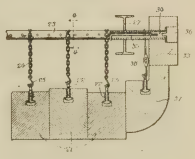
Graphite, 1919–1921. *Imp. Min. Res. Bureau,* 16 pp.(1923).—The world's production of graphite, imports and exports for United Kingdom, Canada, Ceylon, India, Australia, France, Germany, Italy, Sweden, Madagascar, U. S., and Japan, are given in this statistical report, with prices and bibliography. O. P. R. O.

The casting process for glass refractories in German glass tank process. K. ENDELL. *Pottery Gaz.,* **48,** 1964–67(1923).—The principal advantages of the casting process compared with older methods of making pots by hand are (1) a very homogeneous mixt. of the raw clay and grog is obtained, which results in a close texture after firing; (2) unskilled labor is employed in place of highly rated men. The process is not only used for the casting of pots but also for producing large tank blocks and slabs. The difficulty arising in a wider adoption of the process lies in the discovery of suitable casting clays. The suitability of a clay for casting depends upon the possibility of obtaining with the clay and grog mixt. a pouring consistency suitable for casting by the addn. of about 0.25% alkali and 18 to 20% water calcd. on dry wt. of the mix. Many clays which are suitable for making glass pots require too much water to produce a casting slip, for example, Grossalmerode pot clay and Belgian crucible clay from Ardenne region. The difficulties with these clays are due principally to sol. salts such as sulphates. Work is now in progress on freeing clays of sol. salts by electrolysis. In certain clays fluidity can be improved by a small addition of sulphate lye. No difference in refractoriness could be detected in Seger cones between cast and hand made pots, and no perceptible difference was noted between the 2 methods when tested for ability to withstand load at elevated temp. Introduction of finely divided quartz as such or in the form of raw china clay into fire clay mixts. increases the rigidity of the fire clay at high temp. Cast pots are approx. 25% denser than hand made pots, which gives preference to cast pots in melting special glasses such as heavy barium glass which attack fire clay readily. The porosity of cast pots gave values between 19 and 22% whereas hand made pots of the same clay approximated between 24 and 26%. Success of the casting process depends upon careful and trained supervision, proper selection and preliminary treatment of clay. J. W. H.

Intrinsic values of refractory coatings. H. M. CHRISTMAN. *Fuels and Fur.,* **2** [1], 71(1924).—A summation of the destructive forces attacking the refractory and a means of prolonging its life. Coating refractory linings with efficient refrac. cements is suggested to increase furnace efficiencies by preventing corrosive and erosive actions of furnace gases, flames and sand and dust particles, rotting and spalling. R. D. L.

PATENT

Arch construction for furnaces. FRANK B. BIGELOW. 1,488,660, April 1, 1924. In a fur. arch structure, the combination of an arch-plate, an arch-plate brick mounted thereon, a brick arch having a border brick at least in part over said arch-plate brick, and means supporting said border brick from above and capable of permitting variation in the contactual relation of such arch-plate and border bricks.



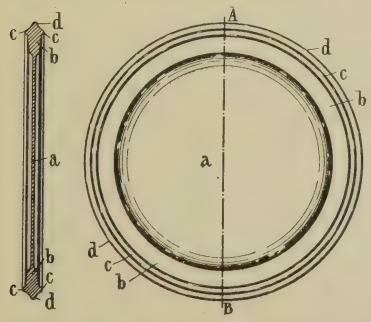
Whitewares

Note on the so-called kaolin of Djebel Debar. A. A. GRANGER AND P. BREMOND. *Trans. Ceram. Soc.*, **22**, 283–285.—In view of the whiteness of the mat., it might be considered valuable in china and earthenware making, but its want of plasticity is a serious drawback in the molding, profiling and casting processes. It should be added to the body in limited quantities only, since it would be incorrect to substitute this halloysitic mineral for china clay. The most serious inconvenience is the necessity to crush the clay with water in a stone or roller mill, the disaggregation with water in the blunger being absolutely ineffective. H. F. S.

The production of earthenware from the biscuit state, including the various stages of decorating. EDMUND SHENTON. *Pottery Gaz.*, **48**, 1947–60(1923).—Abstract of lecture dealing with various kinds of underglaze decoration of English earthenware, *viz.*, sponged ware, band and line printing, the function of hardening kilns. Other topics discussed are underglaze litho, preparation of glaze, dipping, glost placing, glost fire, sorting, liquid gild on glaze printing, hand painting, lithographing on glaze band and line in colors and in gold, ground laying, aerographing, enamel kiln fire and placing. J. W. H.

A century of Straffordshire pottery. WALTON STANLEY. *Pottery Gaz.*, **48**, 1960–63(1923).—An address. J. W. H.

Earthenware biscuit firing. A. G. RICHARDSON. *Pottery Gaz.*, **49**, 273–75(1924).—In the early stages of firing, up to approx. 450°C, an ordinary earthenware body loses 2% of its weight, this loss in weight is almost entirely due to the evaporation of combined water. At 500°C the loss in weight is 3%; at 550°C, it is 5%; at 600°C, it is 6% (the loss now being due to the C as well as moisture) and at 900°C the loss is 7%. No perceptible change in dimensions of the ware occurs until about 1000°C, when contraction takes place rapidly, the contraction at this temp. is approx. $1^1/_2$%; at 1050°C 2%; at 1100°C 4%; and at 1200°C as much as 6%. In ordinary 18 ft. biscuit kiln there is about 10 cwt. of H_2O which must be driven from the ware, and 5 cwt. from green saggers. J. W. H.

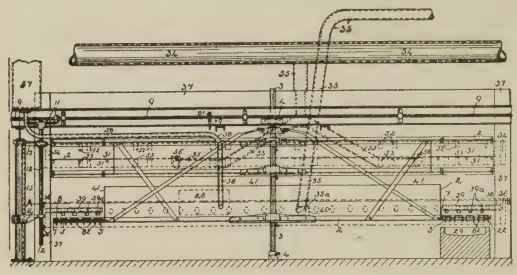


High-voltage (porcelain) insulation. J. L. R. HAYDEN AND C. P. STEINMETZ. *J. Am. Inst. Elec. Eng.*, **43**, 36–43(1924). P. D. V. M. (*C. A.*)

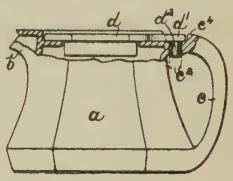
PATENTS

Plate or saucer. EDMUND WILLIAM ABRAM. U. S. 1,488,462, April 1, 1924. A reversible plate or saucer in the form of a one-piece unitary disc dished on both sides thereby to form on each side the food-receiving cavity, said disc having on each side an up-standing bead adjacent its periphery which forms the rim of each dish cavity, said disc extending radially beyond said beads and the extended portion having a progressively decreasing thickness and terminating in a peripheral bead which is located in the plane of the common bottom of the two dishes.

Method of and means for manufacturing teacups, breakfast cups, and other vessels or articles of pottery. ELIJAH BROOKES. U. S. 1,488,973, April 1, 1924. In a casting machine, a frame mounted to revolve on a vertical axis, horizontal mold carriers pivoted in the frame with their pivots arranged radially of its axis, molds arranged in the said mold carriers, and means for tilting the mold carriers on their pivots to discharge surplus material from the molds.



Teapot, coffeepot, jug, and like pouring vessel. JAMES WEBSTER. U. S. 1,489,872, April 8, 1924. In a pouring vessel, a body portion provided with a handle and having a hole at the upper part of the handle and a projection of the handle adjacent to the hole, and a lid disconnected from the body portion and provided with a projection which is slidable vertically in the said hole, said lid having its top portion adjacent to the handle arranged substantially flush with the said projection on the handle.



Equipment and Apparatus

Reduction of blast furnace lining disintegration. H. E. TOWNSEND. *Iron Trade Review*, **74** [3], 232–4(1924).—Linings manufd. in accordance with specif. given by J. W. Gocher showed great reduction in amt. of disintegration. Ferric oxide content was more than 50% lower than usual. Furnace temp. and high CO content in fur. gas were favorable to disintegration. Presence of from 0.10 to 0.15% Zn, in ore mix. substantiates statement by Nesbitt and Bell that "apparently zinc does not cause failure by disintegration." Author states, "ferric oxide content of blast fur. brick must be 50% lower than that of brick usually furnished." T. D. H.

New cupola furnace. E. SCHURMANN. *Iron Trade Review*, **74** [5] (1924).—Two photographs and one complete drawing are given. Blast is preheated and passes transversly across cupola melting zone. Arrangement of refrac. brick checkerwork conserves heat. Pressure and exhaust fans are used and a substantial saving in coke consumption is claimed. T. D. H.

Graphite-clay crucibles for steel. R. T. STULL AND G. A. BOLE. *Iron Trade Rev.*, **74** [7], 487(1924).—Crucibles made from Alabama, Canadian, Ceylon, Madagascar, Montana, New York and Texas graphites bonded with various clays and used on commercial scale for steel and brass melting showed some domestic clays superior to Klingenberg clay. Texas, Alabama and Ceylon graphites, in addition to giving longer life to crucibles, carbonize steel less. T. D. H.

Equalizer app. for transverse tests of bricks. H. L. WHITTEMORE. Bur. Stands., *Tech. Paper*. **251.**—The A. S. T. M. has described the app. to be used for making transverse tests of bldg. bricks. As this app. is made up of many loose parts, considerable time is required to prep. the specimen for test. A new equalizer app. has been designed, built and tested, which gives practically the same values for the modulus of rupture as the A.S.T.M. app. H. F. S.

Application of the interferometer to measurements of the thermal dilatation of ceram. mats. GEORGE E. MERRITT. Bur. of Stands., *Sci. Paper*, **485.**—In this paper an interference method and app. for measg. the thermal expansion of ceram. mats. are described. The samples in the form of small pins, 0.5 to 10.0 mm. in length,

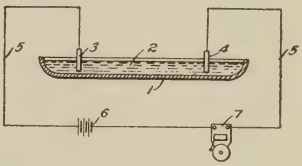
are placed between two fused quartz interferometer plates and heated in an elec. fur. The elongation of the samples is detd. from the numbers of interference fringes that pass reference marks on the interferometer plate while the sample is being heated. A change in length of the sample of 0.025 μ or one-millionth of an in. can be easily detected. H. F. S.

Simple rules for designing resistors. DUDLEY E. FOSTER. *Fuels and Furnaces*, **1** [7], 529(1923).—Design of special resistor furn. is given for any desired temp. up to 1800°F, using nickel-chromium and nickel-chromium-iron alloy wire. Tables for calc. of radn. and convn. losses and proper size and length of wire for definite power input, are given. Example is shown for calcg. necessary power input for a furnace 4 x 4 x 4 in., inside dimensions, with 4 in. insulation. The article provides simple and definite rules for designing small resistor furnaces. R. D. L.

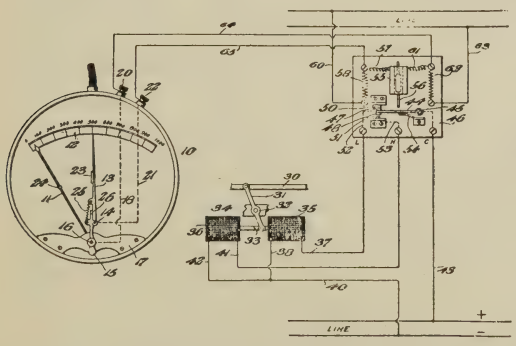
Boilers and engines: How to run them efficiently. J. PHILLIPS. *Trans. Ceram. Soc.* (Eng.), **22**, 286–292. H. F. S.

PATENTS

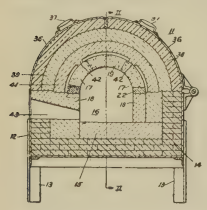
Furnace indicator. CHARLES W. HILL. U. S. 1,489,247, April 8, 1924. A furnace indicator comprising resistance material capable of changing its resistance under reducing conditions.



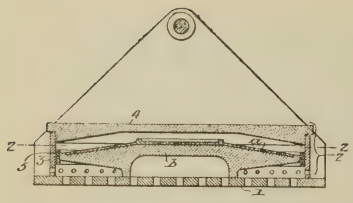
Control thermometer. CHRISTIAN WILHJELM. U. S. 1,489,911, April 8, 1924. In a control system, the combination of a mechanism for controlling the source of heat to a heating zone, a measuring instrument provided with a pointer for indicating the temp. of said zone, a normally energized relay coil, means including a contact arm to coöperate with said pointer when the temp. reaches a predetermined limit to short circuit said relay coil, and means controlled by said relay for operating said mechanism.



Electric furnace. ORA A. COLBY. U. S. 1,490,207, April 15, 1924. In an elec. resistance fur., in combination, a plurality of refrac. walls enclosing a fur. chamber, heating element located in said chamber and comprising a plurality of curved and parallel-extending refractory members of substantially semicircular acurate extent and having their lower ends supported by certain of said walls, refrac. means located at one end of said curved members for elec. connecting them in series-circuit relation, refrac. means located at the other ends of said curved members for maintaining them in substantially parallel relation, terminal electrodes having one end extending through one of said walls and operatively engaging said heating element, and resilient means for maintaining said electrodes in close operative engagement with said heating element.



Process and apparatus for drying pottery. JOSEPH L. BUCKLEY. U. S. 1,490,765, April 15, 1924. In an app. for drying clay bodies, the combination with a tray, a mold

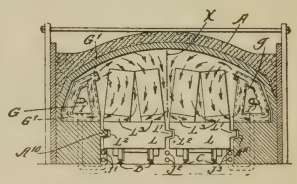


positioned on said tray adapted to support an article to be treated, a metallic ring embracing the periphery of said mold, said ring having one end closed by said tray, and a cover plate of absorbent material for closing the other end thereof, whereby moisture formed on said article, when the same is heated, may be removed.

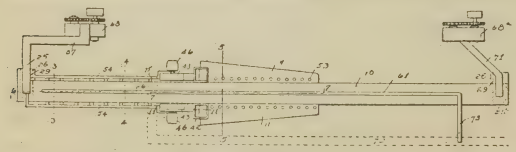
Kilns, Furnaces, Fuels and Combustion

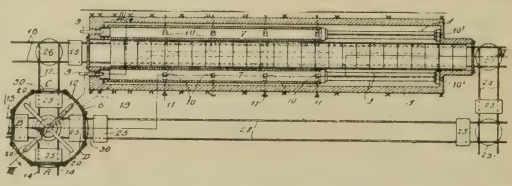
PATENTS

Continuous heating method and apparatus. CONRAD DRESSLER. 1,488,910, April 1, 1924. The method of heating mat. which consists in passing the material in two oppositely moving streams along side by side pathways through an elongated chamber and in subjecting the material in each stream during an initial portion of its travel through the chamber to the action of a set of convection currents of the chamber atmosphere wholly induced by the heat of the adjacent material in the other stream, and to the action of a second set of convection currents of the chamber atmosphere induced by a separate source of heat.

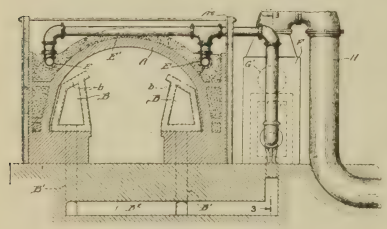


Tunnel kiln. HALVER R. STRAIGHT. 1,489,554, April 8, 1924. In a device of the class described, a tunnel designed to receive a series of movable cars, and to be divided into preheating, burning and cooling zones, and an adjacent and independently constructed furnace at each side of said burning zone, the adjacent wall of each having a series of corresponding openings, each corresponding set of which is provided with a loosely mounted refractory tube for conducting heated gases from the furnace to the said burning zone. In a device of the class described, a tunnel designed to receive a series of movable cars, and to be divided into preheating, burning and cooling zones, a car receiving vestibule at each end of said tunnel, mechanical means for feeding air under slight pressure to the cooling end of said tunnel, and mechanical means for simultaneously producing a slight vacuum at the preheating end, both of said means being capable of producing a constant flow of air under a constant pressure and at a uniform velocity.





Tunnel kiln. PAUL A. MEEHAN. U. S. 1,490,396, April 15, 1924. The combination with a tunnel kiln and its heating means, of an independent preheating chamber, together with means for heating the preheating chamber by the hot products of combustion from the kiln heating means.



Tunnel kiln. HARRY M. ROBERTSON. U. S. 1,490,433, April 15, 1924. The combination with a continuous tunnel kiln having

an outlet for products of combustion adjacent its entrance end and a burner inlet at a point remote from the entrance end of the kiln, of a recuperator connected to said outlet and a conduit for passing air preheated in said recuperator to said burner inlet comprising a portion extending longitudinally of said kiln and located above the latter.

Geology

The kaolin industry in Italy and Sardinia. U. ORZALI. *I. Lareizi ed Affini*, **2** [20], p. 21–3(1924).—A description of the location of various large deposits, their extent and grade of kaolin on the deposit. A large number of analyses are of various parts of the formations. The average analysis was: 40–50 Al_2O_3, 40–50 SiO_2, 10–15 H_2O-Fe_2O_3 is less than 0.5%. The analyses compared favorably with those of kaolins of other countries. A description of the deposits is geologically given. The process of washing the clay is described with various types and possibilities of the use of these beds of kaolin. S. S. C.

Bauxite, 1919–1921. *Imp. Min. Res. Bur.* (1924); *Min. Indus. of Brit. Empire and Foreign Countries* (1923).—This statistical report, aluminium, including bauxite and cryolite, gives rates of exchange, world's production; imports and exports of United Kingdom; Canada; and U. S.; with prices. O. P. R. O.

Arsenical ores (New South Wales). R. H. CAMBADGE. *Chem. Eng. and Min. Rev.* (Melbourne), **16,** 153(1923).—Arsenical mining ore operations have been active at the producing mines, and several promising outcrops in the New England district were located during 1923. A marked increase in the output of arsenic may be expected. O. P. R. O.

BOOK

MILLER, BENJAMIN L., AND SINGEWALD, JOSEPH T., JR.: **Mineral Deposits of South America.** New York: McGraw-Hill Book Co., Inc. 598 pp. $5.00 net, postpaid. (*C. A.*)

Chemistry and Physics

A comparison of the heating curves and quenching methods of melting point determinations. G. W. MOREY. *J. Wash. Acad. Sci.*, **13,** 326–9(1923).—The heating curve method is compared with quenching method which is used in silicate study. The quenching method is more accurate and by heating curve method the true melting point is on the more rapidly rising portion of the curve. Illustration of results given using sodium metasilicate where the results varied but 2° in 1100°C.

S. S. C.

The residue from silica in rock analysis. M. AUROUSSEAU. *J. Wash. Acad. Sci.*, **13,** 330(1923).—The residue from the silica determination was analyzed of a andesite of Lassen Peak, Cal. and was found to contain:

		Of which in the original oxides of the rock this was	
Al_2O_3	13.46		
Fe_2O_3	26.92		
MgO	17.30	Al_2O_3	0.4
		Fe_2O_3 and FeO	3.8
CaO	1.92	MgO	3.3
TiO_2	30.76	CaO	0.02
P_2O_5	1.92	TiO_2	31.4
SO_3	7.69	P_2O_5	0.7

The total amt. of residue was 0.52% of original sample and by calculation it is possible to obtain the per cent of original not obtained by rock analysis. The complexity of the residue analysis raises a question of recovery and value by work involved to obtain results. S. S. C.

Recommended specification for ceramic whiting. Bur. of Stand., *Circ.* **152.**—This circular deals with lime used in making glazes, enamels and similar ceramic products. Ceramic whiting is really calcium carbonate, with or without a small amt. of magnesium carbonate, but it performs the function of lime. It should contain not less than 97% of carbonates, and should be very fine, so that 98% of it will pass a No. 200 screen. H. F. S.

Plasticity and elasticity. EUGENE C. BINGHAM. *J. Franklin Inst.*, **197,** 99(1924).—Plasticity and elasticity are closely related. The stress time curve for lead wire is given showing elastic deformation and recovery, pseudo-plastic deformation and recovery, and plastic deformation. Stress-strain diagrams are misleading beyond the elastic limit if the time factor is lost sight of. Stress-strain diagrams of iron, rubber, steel, zinc, copper and tin are explained. Glass is referred to. Instantaneous rigidity is the resistance to distortion extrapolated to zero time. There are objections to the use of the term resilience beyond the elastic limit, because the time element must be considered. Elastic after-effect is a kind of plastic flow. R. J. M.

The use of filter plates of sintered glass in the chemical laboratory. G. F. HÜTTIG. *Oesterr. Chem.-Ztg.*, **27,** 13; *Z. angew. Chem.*, **37,** 48–50(1924).—The glass-works of Schott and Gen. of Jena will furnish filter plates and filtering crucibles of varying porosity which are made from powd. glass. They can be used in qual. and quant. analysis, in making chem. prepns. and for the expts. of phys. chemistry. W. T. H. (*C. A.*)

A new combined viscometer and plastometer. E. C. BINGHAM AND H. A. MURRAY, JR., *et al.* *Proc. Am. Soc. Testing Materials*, **23,** II, 655–68(1923).—The times required for liquids or soft solids to fill successive portions of a calibrated capillary are measured on a chronograph. As the shearing stress varies along the capillary, the necessary data for a plasticity detn. or for duplicating fluidity detns. are obtained in less time than is often required for single fluidity detn. The method proves reliable when applied to castor oil over a range of temps. Preliminary measurements on a plastic paint give a lower yield value than was obtained with the Bingham and Green plastometer, but as the flow-shearing stress curve is linear it is suggested that there may be more than one régime of plastic flow. The paper is criticized at length by Green. E. C. B. (*C. A.*)

The thermal conductivity and specific heat of coal. F. S. SINNATT AND H. MACPHERSON. *Fuel*, **3,** 12–4(1923).—Because of the wide difference in results published in the past on the thermal condy. and sp. heat of coal, a systematic investigation of the banded ingredients was begun for the first time. The method for detg. the thermal condy. was that of Lodge (*Phil. Mag.*, **5,** 110(1878)) and Lees (*Phil. Trans.*, **184A** (1892)), the principle of which is described by Preston (*Theory of Heat*, 3rd. Ed. 1919). The sp. heat was detd. by Regnault's method of mixts., for which AmOH was most suitable. Values for 3 seams indicated that clarain has a condy. enough lower than durain (av. 0.00042 and 0.00052, resp., in C. G. S. units) to have a distinct effect on the rates at which the ingredients lose or gain heat and consequently to cause unequal stresses with change in temp. which may lead to fracture. Variations in the condy. of different types of coal were roughly proportional to the % ash, the following data giving the % ash and condy. $\times 10^4$, resp.: cannel 24.4, 69; Notts cannel 31.0, 62; shale cannel 33.3, 100; Smith shale 75.3, 110; Scotch oil shale 78.2, 130. In bituminous coals the condy. varied with the H_2O, the following data showing the % ash, % H_2O and condy. $\times 10^4$, resp., for clarain: Barnsley thick 1.0, 9.9, 37; Arley 0.8, 1.5, 43; Trencherbone 2.3, 4.1, 45. The av. *sp. heat of durain, clarain and vitrain* was 0.248, 0.246 and 0.252, resp., and of cannel, shale cannel, Notts cannel, Smith shale and Scotch shale 0.242, 0.226, 0.261, 0.210 and 0.217, resp. The results of the sp. heat show close agreement with those of Cole (*C. A.*, **18,** 577). The work is reported in an incomplete form, owing to its having been suspended. C. C. D. (*C. A.*)

Researches on the relation between the surface, mass and volume of certain crystals. K. HRYNAKOWSKI. *I^szy Zjazd Chemików Polskich,* **1923,** 14–5; cf. *ibid.,* 14.—It is shown that before the expression $dk/d\sigma.\sigma + K = F[\sigma.M_K - f(M_K/d)]$ can be applied to any crystal, it is necessary to obtain the value, P_r, of the function $f(M_K/d).P$; which is the surface of the given crystal. P_r must have as a minimum value that of a sphere of the same vol., P_K, and the ratio P_r/P_K approaches more closely to unity as the symmetry of the crystal increases. For a no. of cryst. substances this ratio ranges from 1.579 for Cu sulfate to 1.307 for sucrose. J. C. S. (*C. A.*)

Some consequences of van der Waals' equation. M. TZENTNERSHVER. *Z. physik. Chem.,* **107,** 81–96(1923).—For 0° the van der Waals' equation is $[p + (a/v^2)](v-b) = 1$. On putting $p = 0$, $(a/v^2)(v-b) = 1$ the roots of which are $v_1 = \infty$, $v_2 = (a/2) + \sqrt{(a^2/4)-ab}$ and $v_3 = (a/2) - \sqrt{(a^2/4)-ab}$. The last two roots are real if $a > 4b$. By substitution for a and b in this inequality of their values in terms of the crit. temp. and pressure the roots are real if the crit. temp. lies over the "limiting temp." 50.56°. When p is plotted against v for the van der Waals' equation, and as v increases from 0 there are first very large negative values of p rising to a max. while still negative then falling to $-\alpha$. On further increase of V, p jumps to $+\alpha$ and falls rapidly to a min., then rises to a max. and finally falls off asymtotically toward the axis $p = 0$. For gases with a crit. temp. under 50.56° the above min. of v falls at a positive value of p. For a gas whose crit. temp. is 50.56° the min. lies at $p = 0$ when $v = 2b$. For gases with a crit. temp. above 50.56° the min. lies in the region of negative pressure so that the curve crosses the axis $p = 0$ in 2 points. For example, with SO_2 which has a crit. temp. of 157.26° and $b = 0.002486$, the three values of v at which $p = 0$ are α, 0.003329 and 0.009831. For the general case of gases at any temp. the limiting temp., T_0, can be computed in the same way and is found to be $T_0 = 0.843T_k$, where T_k is the crit. temp. It is shown further that a *limiting density* and a *limiting mol. vol.* can be derived. F. L. B. (*C. A.*)

Surface films as plastic solids. R. E. WILSON AND E. D. RIES. *Colloid Symposium Monograph* (Univ. of Wisconsin), **1923,** 145–73.—Bubbles from some colloidal solns. show marked stability because the surface films are plastic solids rather than viscous liquids. Other solns. having low surface tension fail to give stable bubbles because they give only fluid films. The plastic solid films are of colloidal, rather than mol. dimensions, and may take hours to attain max. strength; solns. forming such films give erroneously high surface-tension results by the du Noüy and presumably other methods, the yield value of the plastic solid film being added to the true reversible surface tension. In liquid-liquid interfaces in emulsifying agents the production of such films seems to require much higher concns. than in surface films. Plastic solid films of this type are important factors in *lubrication,* being the determining factor in the oiliness of a lubricant, which reduces friction at low speeds and high loads. Discussion follows. J. A. (*C. A.*)

Forces regulating the size of colloidal particles. E. F. BURTON. *Colloid Symposium Monograph* (Univ. of Wisconsin), **1923,** 174–86.—The following aspects are considered: (1) slow rate of fall of small particles; (2) crystal forces at work in forming the nucleus of small particles; (3) role of surface tension in causing agglomeration of small particles; (4) mutual action of colloidal particles due to possession of electrical charges. Under (1) the following (see table) rate of fall is figured out on the basis of Stoke's law for silver particles falling in water (density assumed = 10.5, radius in table = r).

Surface tension contemplates surface with millions of mols., but there may be a lower limit to the size of surfaces to which surface-tension laws apply. Impurities and reaction affect particle growth; thus in alk. soln. NaCl tends to form octahedra, in acid soln. cubes. Expt. points to the existence of very formidable surface-tension forces

r	Velocity, cm. per sec.	Time to fall 1 cm.
1 cm.	200,000	0.000005 sec.
0.1	2,000	0.0005
0.01	20	0.05
0.001	2	5
0.0001	0.002	500
0.00001	0.00002	50,000 sec. = $^1/_2$ day, approx.
0.000001	0.0000002	5,000,000 sec. = 58 days, approx.

acting on small particles. It seems safe to assume that the conglomeration of submicroscopic crystals is regulated chiefly by the fundamental surface-tension law, *viz.*, $(T \times A)$ tends to a minimum. Optical expts. indicate that colloidal particles are usually spherical. In general, cessation of growth seems to be due to elec. charges, which limit the concn. of suspensoid solns., and increase *Brownian motion.* Discussion follows.
J. A. (*C. A.*)

The thirty-two classes of crystal symmetry. J. W. EVANS. *Nature*, **113**, 80 (1924).—A table is published which shows a logical and convenient compilation of data regarding the 32 symmetry classes of crystals. S. K. A. (*C. A.*)

The importance of microanalysis for chemical analysis. L. MOSER. *Microchemie*, **1**, 1–4(1923).—Early in the 19th century the famous chemists were all analytical chemists but later it became the vogue to belittle analytical chemistry and carry out chiefly synthetic researches. Recently, analytical chemistry has been developing along new lines justifying renewed interest in research, and microanalysis represents one of these lines. W. T. H. (*C. A.*)

A new addition to the Soxhlet extraction apparatus. P. H. PRAUSNITZ. *Z. angew. Chem.*, **37**, 50–1(1924).—Filter plates of fused Jena glass may be substituted for the usual paper filter thimbles in the Soxhlet extn. app. These tubes are easily cleaned, and may be fused to the rest of the app. T. S. C. (*C. A.*)

The behavior and properties of magnesium oxide of different origins. M. LEBLANC AND K. RICHTER. *Z. physik. Chem.*, **107**, 357–402(1923).—An exceedingly detailed study is made upon 13 samples of MgO prepd. in various ways, as to purity microscopic and cryst. form, d., drying vol., ordinary and under pressure, amt. of dye adsorption, velocity and completeness of hydration, and the velocity of soln. in weak acids, etc. G. L. C. (*C. A.*)

BOOKS

Science Remaking the World. Edited by Otis W. Caldwell and E. E. Slosson. New York: Doubleday, Page & Co. 288 pp. $2.50. Reviewed in *Ind. Eng. Chem.*, **16**, 211(1924). (*C. A.*)

SVEDBERG, THE: **Colloid Chemistry.** Wisconsin Lectures. New York: Chemical Catalog Co., Inc. 230 pp. $3.00. (*C. A.*)

GREGORY, RICHARD: **Discovery or The Spirit and Service of Science.** American edition. New York: The MacMillan Co. 347 pp. $2. (*C. A.*)

HAMMOND, D. B.: **Stories of Scientific Discovery.** Cambridge University Press. 199 pp. $2.40. Reviewed in *Ind. Eng. Chem.*, **16**, 324(1924). (*C. A.*)

General

China clay and petroleum. ANON. *Chem. Age*, **10**[248], p. 9(1924).—China clay is used to bleach mineral oils replacing bone black. The clay is used as a powder and agitated with oil, being allowed to settle out leaves a clear liquor behind. The clay is dried from 300–400°C. The theory as to the quantity of clay necessary is discussed and the relation of the intensity of the color of the liquid to the absorption by the clay.

The clay should be added methodically to remove each gradation of color and the clay changed after each removal. S. S. C.

Settling of clay suspensions. A. E. SEARLE. *Chem. Age,* **10** [248,] 16–27(1924). —Suspension is dependent on size, shape, specific gravity, temperature of the water and nature of the electrical charge on the particles. Churning with air causes a suspension to settle due to a positive charge on the air bubbles. The use of an electric current is possible to clarify the liquid of the clay particles and still the same size of particle is retained, which is not true when a pptn. is added. S. S. C.

Microscopical examination of china clay. J. M. COON. *Oil & Colour Trade Jour.,* **65,** 457(1924).—China clay enters into such manuf. as paper filling, etc., it is therefore important to have it free from impurities; while chem. and mechanical analyses have their good purposes, a microscopical examn. is extremely valuable as a guide. Elutriation grades the sizes of particles to some extent, but it will not differentiate between the actual mineral constituents. C. prefers to exam. samples microscopically in a castor oil medium although water and Canada balsam may be used. A few milligrams of the sample are put on to a slide, and a drop or so of water added and carefully mixed. If oil is used as the medium, the slide must be dried, and an examn. made first with 1 in. objection, followed by $^1/_4$ in., and then $^1/_8$ in. The various minerals are then looked for, regarding all such as impurities. The paper is further illustrated with figures of the likely mineral constituents (*J. Roy. Mic. Soc.*). O. P. R. O.

Clay products situation throughout Canada. HOWELLS FRECHETTE. *Contract Rec. & Eng. Rev.,* **38,** 183(1924).—A review of mfg. and market conditions in the chief clay working centers of the Dominion based on personal visits paid in a recent survey by F., Chief, Ceramic Division, Mines Branch, Department of Mines, Ottawa. He also deals with some of the troubles which brickmakers experience particularly the fuel problem. Natural gas, a very cheap fuel, has been a wonderful asset to the clay working industries of Medicine Hat and Redcliff, which could not otherwise operate at all. The action of the Saskatchewan Government in establishing a ceramic laboratory and providing a consulting ceramic engineer has been a great assistance to the clay manufacturers of the province. O. P. R. O.

Electrical precipitation of solids in stack gases. SCHROEDER. *Feuerungstechnik,* **12** [9], 65(1924).—Groups fuel losses through the stack under three headings (1) Radiation and conduction, (2) escape of gases of imperfect combustion such as CO, (3) direct loss of fuel in form of soot, coke and ash particles. Tests on different types of boilers showed the loss under (3) to run from 10.6% to 29.7%. F. A. W.

Kaolin as a filler in paper making. ANON. *Indus. Australian and Min. Stand.,* **71,** 4(1924).—If china clay contains more than 2% of sand it is not suitable for use in paper making; in case of coated papers, the proportion of sand must not be greater than 0.1%; in fine grades of paper sand must not be more than 0.25%; in printing-paper the sand in the clay must not exceed 0.5%. Kaolin, added in moderate amount, makes paper more supple and facilitates its finishing; makes it more opaque and better suited for printing purposes; but clay added in too large proportions renders the paper soft and only slightly resistant to folding or crushing. Rigid rules for filling materials cannot be established, owing to the complication of factors that affect their application and which have a great influence on the proportion of the filling materials that remain in the manufactured paper. O. P. R. O.

Asbestos in the Union of South Africa. A. T. JUDGE. *Chem. Met. and Min. Soc. of S. A.,* **24,** 84(1923).—Four different varieties of asbestos are mined in the Union: The serpentine form of asbestos, known as *chrysotile* (a hydrated magnesium silicate, characterized by its high magnesium and water content); the amphibole varieties, *crocidolite* (a silicate of iron and sodium); *amosite* (a silicate of iron with little or no

sodium); *tremolite and asbestic* (which are silicates of calcium and magnesium). This article is well illus. O. P. R. O.

PATENT

Process of manufacturing antifriction bearings and compounds. CARL SCHMIDT. U. S. 1,482,414, Feb. 5, 1924. Process of manufacturing an antifriction bearing composition of a magnesia cement, consisting in mixing magnesiumoxyde (magnesia usta) with wood pulp previously soaked with oil, and chlormagnesialye, the resulting paste being dried to a cement of great sliding ability.

BOOK REVIEW

The Art of the Chinese Potter. R. L. HOBSON AND A. L. HETHERINGTON. New York. Alfred Knopf, 1924. $50.00. One edition limited to 500 copies for the United States. There will be no reprint in any shape or form.

This volume of 192 examples of pottery dates from the Han Dynasty to the end of the Ming. The 53 colored plates and 100 half-tone plates are selected, described and with an introduction by R. L. Hobson, Keeper of the Department of Ceramics and Ethnography, British Museum, author of "Chinese Pottery and Porcelains," etc., and A. L. Hetherington, author of "The Early Ceramic Wares of China," etc. The introduction gives a short account of the general development of the potter's art in China from about 200 B.C. to 1644 A.D., including certain observations based on knowledge recently acquired. The color plates are so good that the collector may compare his specimens with them and note important or minute differences. Each plate has opposite it a detailed description of the body, glaze, decorator, its height, its historical placing, and its owner. Such reproductions as these are the next best thing to living within easy reach of the few museums which have large collections of the originals. The study of ceramics is greatly vitalized in this way for those living at a distance. This book with the text of Mr. Hobson's "Chinese Pottery and Porcelain," are of inestimable value to the collector, the teacher, and the student. Mr. Hobson invites fine artistic judgment with a thorough historical knowledge. The binding is of striped dull blue and dull orange colored paper, with white velum back and corners and gold lettering. The volume measures 8 by $11^1/_2$ inches. MARY G. SHEERER.

CERAMIC ABSTRACTS

Compiled by the

AMERICAN CERAMIC SOCIETY

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[1] The abbreviation (*C. A.*) at the end of an abstract indicates that the abstract was secured from the editor of *Chemical Abstracts* by coöperative agreement.

Art

A study of colored glass from Saint Remi church at Reims. G. CHESNEAU. *Comptes Rendus.*, **178** [10], 852–54(1924).—An article interesting for the history of the technique during the middle ages. The glass from St. Remi is compared with glass of the same color from the Cathedral at Reims which was so much destroyed during the war. The St. Remi glass is a century older than the Cathedral glass. The anal. follows:

	Blue glass		Red glass	
	St. Remi	Cathedral	St. Remi	Cathedral
SiO_2	50.10	53.90	54.10	53.50
TiO_2	Trace	0.20	0.10	Trace
SO_3	Trace	0.20	0.10	Trace
Ig. Loss	0.30	0.40	0.50	0.40
Al_2O_3	4.30	3.90	3.30	3.00
CaO	18.60	19.30	16.60	17.80
MgO	4.70	4.10	4.70	6.10
K_2O	16.70	12.20	15.10	15.00
Na_2O	2.60	1.90	1.90	1.80
PbO	0.10	Trace	0.10	0.03
B_2O_3	0.08	0.02	0.10	0.03
Coloring Agents				
CuO	0.08	0.13	0.20	0.13
CoO	1.03	0.25	0.20	0.13
Mn_3O_4	0.63	3.03	1.22	0.86
Fe_2O_3	0.95	0.79	1.90	0.84
Total	100.17	100.32	99.72	99.46

Excepting the coloring agents, the compns. are very close. It is safe to say the raw materials for the two batches were the same. The workshops which made the glass, a century apart, had the same origin. The blue glass from the Cathedral has a violet tint, while the St. Remi blue is noted for its purity of shade. The CoO is 4 times as abundant in the St. Remi as in the Cathedral, while inversely the Mn_3O_4 is 5 times as abundant in the Cathedral as in St. Remi. The red glass studied in section shows a marked difference in the method of manuf. The glassmakers of the middle ages made the red glass by gathering white glass and covering it with a coating of enamel made from Cu. The Cathedral shows only one coating of red enamel on white glass. The St. Remi shows 5 layers of red enamel which are thinner and of a clearer shade and show numerous defects produced during the drawing of the mass and seems to denote an enamel more fluid than that used in the Cathedral. The Cathedral glass is a deeper red and the enamel is much more uniform. W. R. K.

Colored Ceramics of Assur. J. GR. *Keram. Rund.*, **32**, 161–2(1924).—Ancient ceram. art is described from Assur as was revealed by specimens excavated from this locality. H. G. S.

Shape of clay wares and their etymology. SHINZO OSUKA. *J. Jap. Cer. Assoc.*, **32** [373], 21–26(1924).—The author has long investigated on the etymology of Jap. and Chin. words for ceramic wares. Some of the results are given with many illustrations. S. K.

Experiment on raw lead glaze. TAKEO OSHIDA. *Tokio Indus. Lab. Bul.*, **18** [3], 33–48(1923).—1. *Exptl. formula of the glaze.*—61 formulae of raw lead glaze found in lit. have been tried in the expt., using white lead as the source of lead. 2. *Procedure of expt.*—Each batch of about 300 g. was mixed with 700 cc. of water and ground for

5 hrs. The glaze was applied on cups of feldspathic faience which was composed of 25 washed Kibushi (plastic shale), 25 Shiraetsuchi (kaolin), 15 feldspar and 35 quartzite grog, biscuited at cone 6a and partly painted with cobalt blue, chrome green and chrome pink. The cups were then glost-fired at cones 010a, 05a, 1a and 6a. 3. *Results.*—Results are shown in a table. Picking out those glazes which matured bright at two temps. and have not crazed within 2 years, we have

		Average chemical formula					
Cone No.	Average of	PbO	K_2O	CaO	ZnO	Al_2O_3	SiO_2
010a and 05a	3 glazes	1.00	..	..	..	0.09	1.32
05a and 1a	3 glazes	1.00	..	..	..	0.17	1.28
	1 glaze	0.70	..	0.30	..	0.10	1.30
	3 glazes	0.90	0.03	0.70	..	0.13	1.27
	5 glazes	0.80	0.02	0.14	0.04	0.14	1.26
	18 glazes	0.70	0.06	0.19	0.05	0.19	1.49
1a and 6a	9 glazes	0.60	0.12	0.17	0.11	0.23	1.73
	4 glazes	0.50	0.20	0.10	0.20	0.30	2.10
	1 glaze	0.40	0.20	0.10	0.30	0.30	2.10

Generally speaking, raw lead glaze seriously affects the underglaze color and has a disagreeable yellowish tint due to high content of lead; it is liable to produce flaws and is too fluid. S. K.

Preparation of substitutes for Chinese blue called "Gosu." Ko Ishii. *Rept. Pottery Lab.* (Kioto), [2], 1–28(1923).—1. *Introduction.*—At present, the Chinese cobalt ore called "Gosu" which has long been the most important underglaze color in the Orient is scarce and, moreover, it requires tedious treatments for refining. A few years ago, H. Ueda, head of the lab., studied on its substitutes and patented a process in which coloring metals are pptd. as cyanogen compds. (Jap. Pat. No. 31,722). The paper relates to the systematic study on the patent. 2. *Body and glaze.*—A porcelain body composed of Amakusa (semi-decomposed liparite) 65, feldspar 15 and Gairome (plastic kaolin) 20, and a glaze 0.178 K_2O, 0.065 Na_2O, 0.748 CaO, 0.009 MgO, 0.483 Al_2O_3, 4.73 SiO_2 were used. 3. *Chem. reaction and process of prepg. the artificial color.*—(*a*) $Co_2Fe(CN)_6$, $Mn_2Fe(CN)_6$ and $Ni_2Fe(CN)_6$ were pptd. from solns. of $CoCl_2.6aq$, $MnSO_4.7aq$ and $NiSO_4.7aq$ resp. with $K_4Fe(CN)_6.3aq$. (*b*) $K_3Fe(CN)_6$ was used instead of $K_4Fe(CN)_6.3aq$. The ppts. were washed, dried, ground, and proportioned. The mixt. was then ignited to remove its plasticity. 4. *Comparison of cobalt ferrocyanide and ferricyanide.*—A color consisting of 51.68 Korean kaolin and 48.32 cobalt ferrocyanide proved to be a little superior to that consisting of 46.06 Korean kaolin and 53.94 cobalt ferricyanide. 5. *Mixt. of ferrocyanides of Co and Mn or Ni.*—Ni produces a shade of bluish black or blackish grey. Its action is more violent than that of Mn. Nice purplish indigo was developed with compds. of 44.46–50.05 Korean kaolin, 41.58–46.80 Co ferrocyanide and 13.96–3.15 Mn ferrocyanide, when fired at cone 11 with reducing flame. 6. *Mixts. of Co, Mn and Ni ferrocyanides.*—Among 21 batches tried, the following gave the best results:

Batch	Korean kaolin	$Co_2Fe(CN_6)$	$Mn_2Fe(CN_6)$	$Ni_2Fe(CN)_6$	Color produced
MN_{16}	49.62	46.41	0.75	3.19	Bright purplish indigo
MN_{17}	50.43	47.15	0.80	1.62	
MN_4	43.22	40.42	13.58	2.78	Nice indigo-blue, very close to that of native "Gosu"
MN_6	44.14	41.28	13.87	0.71	
MN_7	46.37	43.35	7.28	2.98	
MN_3	38.76	36.25	24.37	0.62	Dull blackish blue

7. *Further correction of color.*—Varying amts. of $Zn_2Fe(CN)_6$, ZnO, $FeCrO_4$ or $Zn_4(OH)_6CrO_4$ were added to the artificial "Gosu" MN_7 to remove its purplish shade. Mixt. of 93.42% MN_7 and 6.58% $Zn_4(OH)_6CrO_4$ gave a nice result. The latter compd. is obtained by boiling mixed solns. of $Zn(NO_3)_2$ and $K_2Cr_2O_7$. S. K.

Experiment on the Tenriuji-Celadon glaze. Ko Ishii. *Report Pottery Lab.* (Kioto), [2], 55–73(1923).—1. *Introduction.*—Tenriuji is a kind of Celadon having a shade of deep green or slightly yellowish green. The glaze must be transparent, bright and free from crazing. 2. *Basal glaze and body.*—It is known that iron glazes rich in potash and poor in lime favor the production of Kinuta-Celadon which has indigo shades while those rich in lime tend to produce Tenriuji-Celadon which has green shades. Therefore, 9 glazes within the range of $\left.\begin{matrix}0.2K_2O\\0.8CaO\end{matrix}\right\}$ 0.3–0.5 Al_2O_3.3.0–4.0 SiO_2 have been tried, adding 3.5 ferrous silicate and 0.05 chromium oxide to 100.0 batch of each basal glaze; ferrous silicate was prepd. by htg. a mixt. of 1 mol. FeO and 3 mol. SiO_2 to cone 11 with reducing flame. Body was composed of 60 Amakusa, 15 feldspar, 25 Gairome and 2 ferric oxide. 3. *Glazing and firing.*—Wares were dipped in or poured with pretty thick glaze, dried thoroughly and, then coated with thicker glaze slip containing Funori glue by means of a brush. The latter treatments were repeated 2 or 3 times more. Glaze must be crushed to pass through a $^1/_{16}''$ mesh sieve and then ground 20 hrs. in a pot mill. After glazing, the wares were fired at cone 9–10 with reducing flame of wood. The best result was obtained with basal glaze VI which corresponds to $\left.\begin{matrix}0.2K_2O\\0.8CaO\end{matrix}\right\}$ 0.4-Al_2O_3.4.0SiO_2 and was composed of 21.0 limestone, 14.6 feldspar, 58.0 Amakusa and 6.4 silica. The color was bright light green. 4. *Effect of chromium oxide as auxiliary colorant.*—Chrome green is not affected by the nature of flame. Therefore, chrome Celadon is widely made by adding chromium oxide in its glaze or body, though it appears mean and is deficient of brightness on account of its turbidity. However, its slight addn. as described in 2 is desirable, because it makes the Celadon deep green. Expt. has proved that 0.05 chromium oxide to 100.0 basal glaze is the best proportion. 5. *Effect of rutile as auxiliary colorant.*—Addition of 0.20–0.30 rutile to 100.0 glaze VI and 3.5 ferrous silicate produced nice green, while 0.40–0.50 rutile gave good yellowish green. 6. *Effect of manganese carbonate as auxiliary colorant.*—Celadon glazes contg. manganese carbonate are deeply affected by the nature of flame. However, those composed of about 4.5 manganese carbonate, 3.5 ferrous silicate and 100.0 glaze VI gave excellent green Celadon when fired in perfectly reducing atmosphere. S. K.

Manufacture of calcareous faience from Terayama white clay and Iwaki shale. Jirokichi Kumazawa and Takehiko Ukisu. The Tokio Industrial Lab., *Bull.* **18** [3], 1-32(1923).—Terayama white clay is a fine siliceous clay produced at Terayama Izuminura, Enyagun in Tochigi Prefecture as decompn.-product of liparite. Its anal. is: Loss on ig. 5.66, silica 79.25, alumina 14.16, ferric oxide 0.59, lime 0.19, magnesia 0.08, potash 0.04 and soda 0.36%. It burns white and melts at cone 2830. On the other hand, Iwaki shale, chiefly produced in Akai district of Iwakigun, is a fire clay with refractoriness of cone 31–34. Wares made of 30 different compds. consisting of 15–35 Iwaki shale, 5–30 limestone and 80–35 Terayama white clay were biscuited at cones 3a, 5a and 6a and then glost-fired at cone 05a after applying a glaze as $\left.\begin{matrix}0.25Na_2O\\0.10K_2O\\0.10CaO\\0.55PbO\end{matrix}\right\}$ $0.30Al_2O_3$ $\left.\right\}$ $\begin{matrix}3.0SiO_2.\\0.5B_2O_3\end{matrix}$ Results, in short, are: (1) The white clay favors shivering, no compd. being safe for 3 biscuit temps., though several were free from shivering at each temp.; (2) Iwaki shale cannot be used for pure white ware. The

authors exptd., at the same time, on 24 different compds. consisting of 20–35 Tokiguchi Gairome (plastic kaolin), 5–30 limestone and 75–35 Terayama white clay in the similar way with the result that those with the propns. as 25:15:60, 30:10:60, 30:15:55, 30:20:50 and 35:15:50 give excellent results for any of the 3 biscuit temps. S. K.

Experiment on the manufacture of leadless overglaze colors. JIKEI UEDA. *Rept. Pottery Lab.* (Kioto), [2], 29–54(1923).—1. *Introduction.*—The paper relates to the elimination of lead with bismuth. 2. *Manuf. of leadless fluxes.*—(*a*) Flux composed of bismuth oxide and silica. Essential constituents of lead fluxes are lead oxide and silica. But similar fluxes as $Bi_2O_3.(1–3)SiO_2$ are too hard. (*b*) Flux composed of bismuth oxide, alkali and silica. Flux $\left.\begin{matrix}Na_2O\\Bi_2O_3\end{matrix}\right\}5SiO_2$ is still too hard and, moreover, is useless for ferric oxide red as its high content of alkali badly affects the color. (*c*) Fluxes composed of bismuth oxide, boric acid, alkali and silica. Flux $\left.\begin{matrix}K_2O\\Bi_2O_3\end{matrix}\right\}\begin{matrix}3B_2O_3\\2SiO_2\end{matrix}$ is pretty good for blue, green and black colors, although it is too sol. in water. Flux $\left.\begin{matrix}K_2O\\2Bi_2O_3\end{matrix}\right\}\begin{matrix}6B_2O_3\\4SiO_2\end{matrix}$ is better, as it is less sol. (*d*) Fluxes composed of bismuth oxide and boric acid. The author has got best results with these fluxes. Flux I $Bi_2O_3.3B_2O_3$ is suitable for blue, green and yellow colors. Flux II. $Bi_2O_3.4B_2O_3$ is suitable for red and black colors which require high propn. of colorants. Both fluxes were prepd. by melting batches composed of boric acid and bismuth oxide or subnitrate in biscuited crucible of chem. porcelain which had an aperture in its bottom. 3. *Manuf. of leadless overglaze colors.*—(*a*) *Blue color.* A nice blue color was obtained when 100.0 Flux I was mixed with 10.0 blue stain which had been prepd. by htg. a batch consisting of 25 cobalt oxide, 50 aluminium hydroxide and 25 aluminium sulphate at cone 10 or higher. (*b*) *Green color.* A green of medium intensity was produced with a color consisting of 100.0 Flux I and 7.0 chromium oxide. (*c*) *Yellow color.* An orange yellow color was obtained when 10 am. uranate was mixed with 100 Flux I. A colorant obtained by igniting a batch as 16.0 stannic oxide, 32.0 antimony oxide, 52.0 bismuth oxide and 2.0 ferric oxide at about 700°C produced a very nice yellow when it was mixed with 10 times Flux I. (*d*) *Red color.* Best propn. of Flux II and ferric oxide is 80.0:20.0. Black shade in the red owes to the quality of the oxide. It is best corrected by adding 10 alumina to 100 ferric oxide. Excellent result was obtained when carbonates of Fe and Al were pptd. from a mixt. of acidified soln. of $FeCl_3$ and aq. soln. of $Al_2+(SO_4)_3.18H_2O$ with sodium carbonate soln. It has to be thoroughly washed, dried and ignited at about 750°C in oxidizing atmosphere. On the other hand, mixed soln. of $Fe(NO_3)_3.9H_2O$ and $Al(NO_3)_3.8H_2O$ may be treated with ammonia. Latter process is much more simple. (*e*) *Black color.* The best result was obtained with a color consisting of 20.0 stain and 80.0 Flux II. The stain was prepd. by igniting a mixt. of 40.0 cobalt oxide, 20.0 ferric oxide, 20.0 manganese oxide and 20.0 chromium oxide at cone 10. S. K.

Gift of a collection of Japanese ceramics. ANON. *Bull. Met. Museum Art,* Jan., 1924.—The Brinkley collection of Japanese Pottery given to the Museum in memory of Charles Stewart Smith has been one of the chief prides of the Museum. This has just been augmented by the gift of another collection from Mrs. V. Everit Macy. The second collection is equal to the first in merit and importance and is different enough in composition and detail to complete the series, and fill in the gaps. There is now no other collection that can rival it even in Japan. A. A. A.

A neo-Attic marble vase. ANON. *Bull. Met. Museum Art,* Jan., 1924.—A recent and important acquisition in the Classical Department of the Museum is a large marble vase decorated with dancing women in low relief, a product of the art of the early Roman Empire. Large marble vases with ornamental reliefs must have been very popular

in Roman times for a great many have survived. Examples particularly close to ours are in the Museum of the capitol and in the Vatican. The three most famous are in the Louvre, the Capitoline Museum, and in Naples. Artistically our example ranks as one of the finest known and demonstrates the high level attained during the early Roman Empire in the decorative field. A. A. A.

Windows of old France. CHARLES J. CONNICK. *International Studio,* Jan., 1924.—The character and artistic influence of Abbot Suger seen in stained glass of Cathedrals of Saint Denis and Chartres. This article is continued in the Feb. number. A. A. A.

Old China from Chelsea. MRS. GORDON STABLES. *International Studio,* Feb., 1924.—This is an interesting story of the wealth of artistic figures produced in one factory in England in a few years, nearly 2 centuries ago. A. A. A.

Gifts from the Carnarvons. ANON. *Bull. Met. Museum of Art,* Dec., 1923.—Following Lord Carnarvon's tragic death it was found he had given to the Museum a very valuable latiform vase of opaque glass, of a delicate turquoise blue color, the rim mounted in gold and bearing on the side an inscription dating the vase to the reign of Thutmose III of the XVIIIth dynasty. It is one of the most important examples of Egyptian glass making and is the chief point of interest in the Museum collection of that period. The Countess of Carnarvon has given the superb alabaster (aragonite) vase $15^1/_2$ inches in height, bearing the name of King Merneptah of the XIXth dynasty. One of 13 such vases found in 1920 in the Valley of the Kings, by Lord Carnarvon and Howard Carter. Another gift, through the generosity of V. Everit Macy is a very rare piece of Egypto-Syrian enameled glass, the known specimens of which precious objects number only 400 including fragments. In the Arabic Museum at Cairo there are 68 specimens and the next largest collection is owned by our Metropolitan Museum. This last acquisition is a magnificent specimen of the rarest type of Egypto-Syrian glass, a sweetmeat bowl in the form of a tall standing cup with intricate patterns delicately wrought in red, blue, green, yellow and white enamels and in gold. The glass is rather thick showing characteristic air bubbles—Early 14th Century. A. A. A.

Mosaics old and new. F. E. WASHBURN-FREUND. *International Studio,* April, 1924.—A story of the modern revival of the greatest art of the early Christian era. A. A. A.

Color measurements. L. A. JONES. *Am. Dyestuff Rept.,* **13,** 121–31(1924).—About 2 pages of exts. are quoted from the report of the Colorimeter Committee, Optical Soc. Am. Many technical terms for the different attributes of color are defined from a modern point of view. Spectral energy, spectral photometric transmission and density, hue sensibility, and satn. sensibility are illustrated by graphs. The Nutting monochromatic analyzer and the Eastman universal colorimeter are illustrated and described. L. W. R. (*C. A.*)

Cement, Lime and Plaster

On the properties of cements for paving. KUICHI KOYAMA. *J. Jap. Cer. Assoc.,* **31** [372], 400–6(1924).—Jap. Specif. of Port. cement are criticized for its use in paving. Italian Soliditit cement, analyzing as silica 34.27, alumina 11.87, ferric oxide 5.00, lime 42.40, magnesia 0.68, potash 0.51, soda 2.99, sulphuric anhydride 1.38, sulphur 0.01 and loss on ig. 2.80%, was used in some exptl. road in Tokio and Osaka whose result is not yet reported. S. K.

Enamels

Studies growth of gray iron. T. E. HULL. *Foundry,* **52** [7], 253–4(1924).—The first growth of cast iron is due to occluded gases, which being liberated under press.,

cause deformation of the graphite crystals. This opens up avenues for the entrance of oxygen to the iron. The second stage of growth is due to oxidation of iron silicide. As the point of max. growth is approached, some free iron is oxidized. M. E. M.

Glass

Making Fourcault flat glass at the Fairchance factory. J. M. Hammer. *The Glass Worker*, **43** [27], 9(1924).—The first Fourcault flat glass made east of the Mississippi is at the plant of the Quertinmont Glass Co., Fairchance, Pa. Four machines are in operation on glass from single strength to 42 oz. The distance from the tank to the cutting table is 18 ft. The glass is drawn through a clay guide and pulled upward by asbestos rollers to the cutting off floor. Sheets range from 72″ to 78″ long by 54″ wide. Modern equipment is used throughout. R. J. M.

The glass container and public welfare. J. G. Jennings. *Glass Container*, **3** [6], 5–7(1924).—One of the arguments made before the Interstate Commerce Commission in the pending Food Packer's Classification Case showing conclusively why the rates on food products packed in glass should enjoy the same rates as the same products packed in tin and other containers. W. M. C.

The importance of the milk bottle as a factor in public health. Anon. *Glass Container*, **3** [6], 8, 26, 34(1924).—The glass bottle is a factor no less important than pasteurization in protecting the health of the populace. The great reduction in infant mortality and many other blessings of pure milk are thus in largest measure due to the sanitary milk bottle. The bottle, commonplace as it is in our daily life, and insignificant though it may seem to the casual, is a vital protecting agency. Gives a tabulated report of an investigation made with 60 of the larger cities in the U. S. to det. the percentage of milk sold in glass bottles. W. M. C.

Glass makes travel safe for those who go down to the sea in ships. Anon. *Glass Container*, **3** [6], 10, 11, 44(1924).—Striking development of powerful lights and lighthouses in contrast to ancient fires on shore and essential part of glass in this evolution. W. M. C.

On the weathering of bulb glass. Sangoro Takahashi. *J. Jap. Cer. Assoc.*, **32** [373], 1–5(1924).—In the first part, the results of expts., in which published methods of testing glass on chem. behavior of its surface had been followed, are given. 4 glasses with formulae of (1) $0.9Na_2O.1.1PbO.6SiO_2$, (2) $1.3Na_2O.0.7CaO.6SiO_2$, (3) $0.6Na_2O.2.0B_2O_3.6SiO_2$ and (4) $0.8Na_2O.0.4K_2O.6SiO_2$ were used in the expts. The results were as follows:

	Glass loss which occurs when glass ground to pass through a No. 20 sieve is digested in water of an autoclave		Blooming of glass beads when they are htd. in steam of an autoclave		Alkali taken up by 150 cc. of water 92°C in 1 hr. per 5 g. of glass ground to pass through a No. 25 sieve, expressed in mg. of soda	Devitrification caused by htg. glass for 3 hrs. in an elec. fur. (5–7 hrs. were required for cooling)			
	4 atm. 2 hrs.	6 atm. 3 hrs.	4 atm. 2 hrs.	6 atm. 3 hrs.		500°C	600°C	700°C	800°C
(1)	0.04%	0.10%	None	Slight	1.52	None	Medial	Remarkable	Remarkable
(2)	0.48%	1.14%	Medial	Remarkable	7.47	None	None	Medial	Remarkable
(3)	0.60%	5.16%	None	None	15.93	None	None	None	Medial
(4)	19.35%	29.07%	None	None	48.36	None	None	None	Medial

Crystals due to weathering occur usually on inner surface of the bulb before sealing Glass (1) was most insusceptible to weathering, though its crystal was only removed

with dil. soln. of HF. Then the app. for testing glass on its resistance to weathering is described. It is a wooden box with a door which is heated elec. and has a producer of CO_2 or other gas and a water pan or a drying app. When glasses are put in moist air of the app., temps. 30–40°C are most favorable to their weathering. Introduction of CO_2 accelerates it. Glass (1) has been weathered in 3–7 days in the app., while it requires 2 months even in rainy season for its testing in ordinary atmosphere. Microphotographs are given. S. K.

Coloring action of bismuth on glass. KITSUZO FUWA. *J. Jap. Cer. Assoc.*, **32** [373], 5–18(1924); cf. *Ceram. Abs.*, **2** [11], 242–4(1923).—282 batches of various glasses were melted to find the influence of their chem. compn. on the coloring action of Bi compds., with or without addn. of oxidizing or reducing agent. Chem. formulae of the glasses were $R'_2O.R''0.3SiO_2$ and $R'_2O.R''O.0.5B_2O_3.3SiO_2$, where R′ and R″ represent Na or K and Ca, Mg, Zn, Ba or Pb, resp. 1. *Basic carbonate of Bi,* $2(BiO)_2CO_3.H_2O$.—2.5–5% of the carbonate imparts a color which varies from gray to brown to most glasses, while the others remain colorless. Generally speaking, the color is lightest in borosilicate glasses and darkest in boronless potash glasses. Reheating favors the brown coloration, sometimes opacifying the glass. These changes occur usually at surface in borosilicate glasses. The brown or gray coloration of Bi glasses may be attributed to the formation of colloidal Bi. 2. *Bi subnitrate,* $Bi(OH)_2NO_3$.—The coloration is generally weaker than in 1, but the difference disappears on reheating. 3. *Basic carbonate of Bi and K nitrate.*—Addition of an oxidizing agent as K nitrate reduces the coloration, the tendency being observed even after reheating. 4. *Basic carbonate of Bi and K tartarate.*—The reducing agent has little influence upon the action of the carbonate. 5. *Basic carbonate of Bi and arsenious acid.*—0.5–1.0% of arsenious acid added to the batches prevents the glasses from being colored by the Bi carbonate, though the reheating reduces its influence. S. K.

Color imparted to glass by stannic oxide. KITSUZO FUWA. *J. Jap. Cer. Assoc.*, **32** [373], 18–20(1924).—Amts. of stannic acid required for opacifying various glasses are given.

Formula of glass	Stannic acid added. (%)	Appearance of glass	Appearance after reheating
$1.3Na_2O.CaO.6SiO_2$	25.0	Transparent	Transparent
$1.3K_2O.CaO.6SiO_2$	30.0	Transparent	Transparent
$1.3Na_2O.MgO.6SiO_2$	20.0	Light bluish and opal	Light bluish and opal
$1.3Na_2O.MgO.6SiO_2$	30.0	Opal	Opal
$1.3K_2O.MgO.6SiO_2$	10.0	Like Alabaster	Like Alabaster
$1.3Na_2O.ZnO.6SiO_2$	25.0	Transparent	Transparent and iridescent
$1.3K_2O.ZnO.6SiO_2$	40.0	Transparent	Transparent and iridescent
$1.3Na_2O.BaO.6SiO_2$	25.0	Transparent	Transparent
$1.3Na_2O.BaO.6SiO_2$	30.0	White and opaque	White and opaque
$1.3K_2O.BaO.6SiO_2$	30.0	Transparent	Slightly iridescent
$1.3Na_2O.PbO.6SiO_2$	20.0	Greenish and opaque	Gray in surface
$1.3K_2O.PbO.6SiO_2$	20.0	Opaque	Opaque

S. K.

On the waste gases of tank furnace. HIDEO IWAI. The Asahi Glass Co., *Bull.* [9], 37 pp.(1923).—Elaborate expts. on the waste gases of the Siemens regenerative tank fur. at the Tsurumi plant of the Co., manufacturers of window glass, are described. Reversing of air and producer gas currents occurred every 20 min. Results: 1. *Temp. of the waste gases.*—The av. temp. at the outlets of air regenerators, the inlet of air valve,

its outlet, the middle of flue and the foot of stack were 466°, 432°, 330°, 316° and 301°C, resp. 2. *Compn. of the waste gases.*—Anals. of the hot gases, expressed in volume %, at the inlet and outlet of the air-reversing valve were:

	CO_2	O_2	N_2	H_2O
At the inlet	9.9	3.0	71.9	15.1
At the outlet	7.9	6.2	74.0	12.0

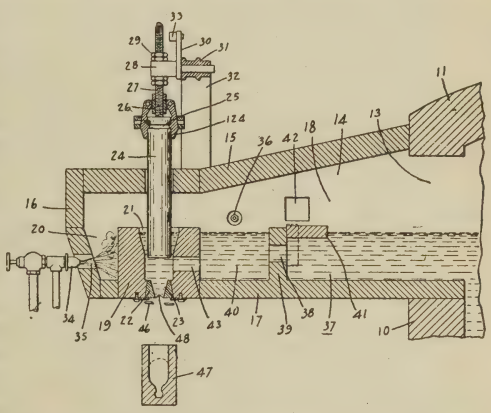
3. *Amt. of the waste gases, leakage of air at the valve and calcn. of air excess.*—Amts. of the gases at the in- and outlets of the valve were 12.73 and 15.97 l. per kg. of coal, resp. The leakage of air at air valve was 25.4% in volume. Excess of air was 39.6%. 4. *Calcn. of the waste heat.*—Heat of the waste gases at the inlet of air valve corresponded to 39.5% of that generated by coal, taking the latent heat of aqueous vapor in calcn.

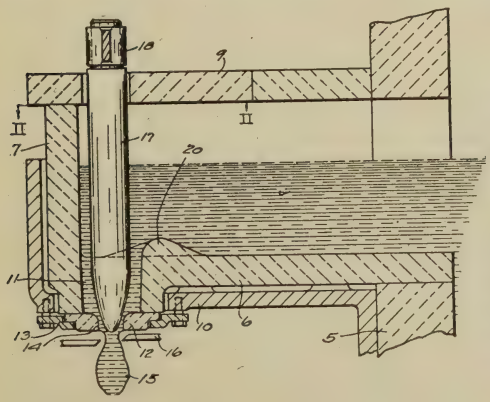
S. K.

Properties of pitch used in working optical glass. F. W. PRESTON. *Trans. Optical Soc.*, **24**, 117–40(1923). E. J. C. (*C. A.*)

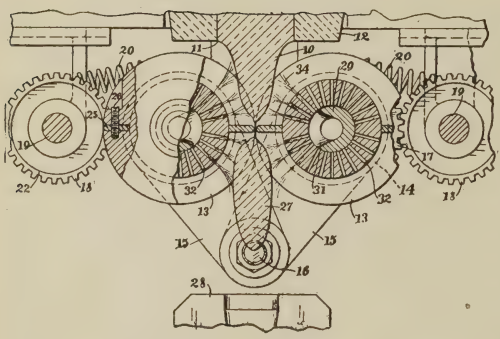
PATENTS

Glass-feed mechanism. JOHN RAU. U. S. 1,491,067, Apr. 22. The combination with a glass tank, of a glass discharge spout into which the molten glass is adapted to pass, said spout being provided with a receiving chamber, a feeding chamber sepd. therefrom by a partition having a feed opening therethrough, a float valve for opening or closing said opening, a plunger chamber positioned adjacent said feeding chamber and communicating therewith through a plurality of passageways, one above the other, a plunger adapted to be reciprocated within said plunger chamber for forcing the glass through an orifice in the bottom thereof, and means for maintaining the glass contained in said plunger chamber at a high temperature, said means comprising a space between the ends of said spout and wall of said chamber, and a nozzle for engaging a flame therein for heating the glass contained in said plunger chamber to a high temp. substantially as described.



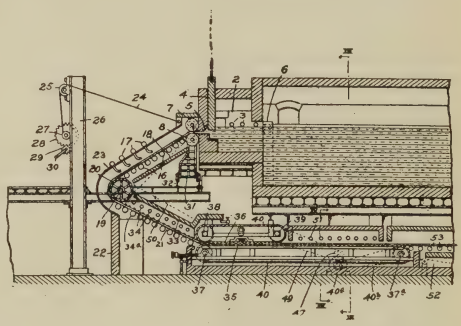


Glass feeder. RICHARD LA FRANCE. U. S. 1,490,930, Apr. 22. The combination of a fur., a forehearth of boot extending therefrom, said boot provided with a discharge opening through the bottom thereof, and a plunger projecting downward into said opening, said floor being provided with a hump or raised portion directly behind the plunger and beneath the normal level of the glass, the width of the hump being equal to or greater than the diameter of the discharge opening.



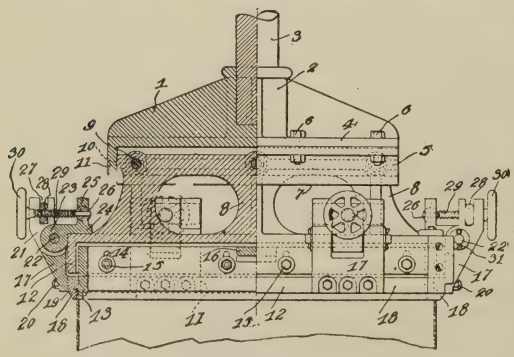
Means to produce charges of hot glass. LEONARD D. SOUBIER. U. S. 1,490,946, Apr. 22. The combination with means to flow a stream or column of molten glass, of a pair of forming rolls provided with recesses in their peripheries arranged to embrace the flowing glass, and means to supply burning gas to envelop the glass as it passes between the rolls.

Process and apparatus for making sheet glass. JOHN H. FOX. U. S. 1,492,975, May 6. The process of making sheet glass which consists in conducting molten glass laterally from a relatively large body rolling or sizing the sheet to uniform thickness, fire finishing the upper surface of the sheet as it moves forward, turning the sheet to bring the upper surface down and its other surface up and then fire finishing such other surface which is not up, all during the continuous forward movement of the sheet.



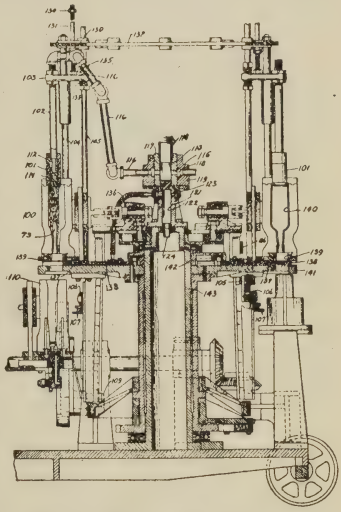
Machine for working on glass. WALTER J. LEVERIDGE and PAUL SCHWERIN. U. S. 1,492,602, May 6. A machine for inserting wires into glass rods comprising a mold receptacle for the rods, means for heating the rods, lever mechanism for feeding the wires up to the rods, a second lever mechanism for slowly forcing the wires into the rods, cam mechanism for cutting off the wires a definite distance from the points of insertion and after insertion, and lever mechanism for ejecting the rods with the wires inserted into said receptacle.

Glass-drawing machine. ARTHUR HOUSSIERE and JULES HOUSSIERE. U. S. 1,491,749, April 22. A glass drawing machine including a holder, a carriage movably suspended from said holder, stationary jaw members detachably connected to the carriage and mounted for adjustment thereon, movable jaw members supported by the carriage and adapted to be moved toward and away from the stationary jaw members, screw members loosely connected with the carriage and having engagement with the movable jaws whereby adjustment of said screw members will move the movable jaws toward and away from the stationary jaws.



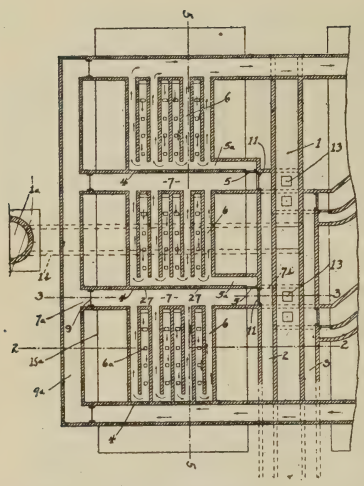
Glass-manufacturing machinery. SAMUEL E. WINDER. U. S. 1,491,369, Apr. 22. In a glass molding machine a rotatable table, a brake drum fixed to and concentric with

said table, an arm rotatably mounted on said machine coaxially with said table, a pin mounted on said arm, a member pivoted to said machine adjacent the periphery of said drum, a brake band encircling said drum, one end of said band being fixed to said machine and the other end being fixed to said member, a plate pivoted to said machine coaxially with said member and extending across the path of motion of said pin, and resilient adjustable means preventing the rotation of said plate away from said path of motion without rotating said member. In a glass molding machine, a rotating molding mold table and rotating blowing mold table, a plurality of molds on each of said tables, means for rotating intermittently each of said tables, the edges of said blowing mold table projecting over the edge of said other table, whereby as said tables are actuated one of the molding molds comes to rest immediately under one of said blowing molds in the elevating position, means for successively elevating glass means from said lower molds to said upper molds when they are in the elevating position, said elevating means comprising an elevating member, means for passing said member downwardly through a blowing mold before said member reaches the elevating position, means for lowering said elevating means onto said glass mass after the mold comes to rest in the elevating position, means for then elevating said member while supporting said glass through the blowing mold, in combination with means for blowing said glass mass in the blowing mold while still supported by said elevating means and as said mold is being moved to other positions. In a glass molding machine means for transferring molded articles from said machine, said means comprising a lever mounted for rocking in a horizontal plane, rocking means connected to said lever, clamping means fixed to one end of said lever, a second lever mounted on said lever and for horizontal rocking, means for opening and closing said clamp fixed to one end of said second lever operable as said lever is rocked, means fixed to said machine for rocking said second lever as said first mentioned lever is rocked in one direction, and other means fixed to said machine for rocking said second lever as said first mentioned lever is rocked in the other direction, and means for locking said clamp in its closed and its open positions.



Heavy Clay Products

Quality of common brick manufd. in Japan. SAKUHEI KOBAYASHI. *J. Jap. Cer. Assoc.*, **32** [374], 57–68(1924).—In Jan., 1922, the Brick Committee of the Engineering Stand. Comm. of the Jap. Govt. resolved to investigate on the quality of common brick manufd. in the country and, thereafter, 115 kinds of common brick made by 18 works have been tested in the Tokio Industrial Lab. The author summarizes the results obtained by Mr. Maruta and Mr. Nakai. Conclusions are: 1. Crushing strength of common brick manufd. at a plant increases as their absorption decreases. Absorption is, however, never a measure of crushing strength for brick manufd. at different works. 2. The crushing strength-absorption curve indicates that Japanese brick can be classified in (1) those with crushing strength over 350 kg., (2) those with the strength from 350 to 200 kg. and (3) those having the strength under 200 kg. per sq. cm. Absorption of class (1) is less than 9% for brick of Western districts while it is within

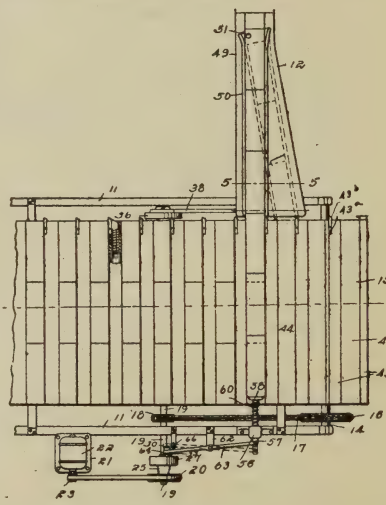


14% for those of Eastern districts. Absorption of class (2) is 9–14% for Western brick and 14–18% for the Eastern. S. K.

PATENTS

Brick kiln. HENRY WEBSTER. U. S. 1,491,180, Apr. 22, 1924. In a kiln, the combination of a firing chamber, means for firing said chamber along the sides thereof, a main flue, another chamber having a solid, permanent wall between it and the first chamber, a space between the two chambers having a valved connection between it and the main flue, and direct communication with the one chamber, and valved connection with the other chamber, said other chamber having likewise a connection with the main flue.

Device for handling and arranging brick. HALVER R. STRAIGHT. U. S. 1,492,864, May 6. In combination, means for conveying a continuously moving row of brick, a conveyor having a series of equidistant and transverse grooves capable of being moved transversely with respect to the row of moving brick, means for automatically and intermittently advancing said conveyor, a pivoted conveyor for transferring the brick from said moving row to one of said receiving grooves, automatic means for swinging the free end of said pivoted conveyor to transfer brick to an adjacent groove when the first said groove has become filled, and means for returning the transfer conveyor to its original position of movement simultaneously with the advance of the said transversely moving conveyor.



Refractories

Determination of thermal conductivity of refractories. M. HERSEY AND E. BRITZLER. *J. Wash. Acad. Sci.*, **14**, 147(1924).—The condy. was detd. using the same type of heaters as had been done in previous work. The condy. was calcd. by $\frac{K = H}{AG}$ where H = heat flow through area A and G = temp. gradient and this is $G_0 = \frac{t_1 - t_2}{x}$ where x = thickness of layer of brick between two isothermal planes t_1 and t_2. G may be calculated by $G = G_0\left(t + \frac{dG}{G_0}\right)$ with $\frac{dG}{G_0} = 4\left(\frac{t - t_m}{t_1 - t_2}\right)$ t_m = observed temp. of interior, $t = \frac{t_1 + t_2}{2}$, t_1 and t_2 are hot and cold face temp., respectively. The values of Hytex and Georgia fire brick were obtained and found to be for Hytex 0.0029 (cgs.) at 260°C and 0.0027 (cgs.) for Georgia at 945°C and 0.0019 at 290°C. S. S. C.

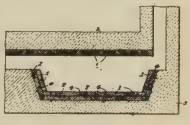
Texture and heat conductivity of refractory stone. M. JAKOB. *Z. Ver. deut. Ing.*, **67**, 126–7(1923); cf. *C. A.*, **16**, 2187.—The differences reported by various observers (references to which are given) in the heat condy. of $MgCO_3$, some values differing 20-fold, can be explained by differences in cryst. texture. It should, therefore, be possible, by suitable mixing and heat treatment, to control the heat condy. and temp. coeff. of ceramic products. In this connection the condy. can be increased by the addn. of graphite (cf. *Ann. chim. phys.*, **25**, 137(1912)). C. C. D. (*C. A.*)

BOOK

Refractories for Electric Furnaces. 2nd ed. Columbia Univ., New York: Am. Electrochem. Soc. 96 pp. $1.00. (*C. A.*)

PATENTS

Refractory lining for metallurgical purposes. EDWIN W. HALE. U. S. 1,492,685, May 6. As an article of manuf., a container for molten metals and other materials, the portions of the lining of which container most liable to be exposed to the destructive action of the molten materials and gases are faced with bricks made of an alloy containing chromium.



Refractory product. ARTHUR P. TAYLOR. U. S. 1,491,567, April 22. As a new article of manuf., a refractory product consisting substantially of diaspore and kaolin and having a fusing point greater than cone 35, substantially as described.

Refractory article and process of making the same. HUGH S. COOPER. U. S. 1,491,224, Apr. 22. A refractory article consisting of zirconia bonded by relatively fusible impurities therein, said impurities being present in amounts not substantially impairing the refractory properties of the article.

Whitewares

Suspension insulator for trolley lines of industrial railways. F. BIELEFELD. *Elek. Zeits.* [1], 6–8(1924).—A new type of porcelain insulator D. R. P. 325,488 designed for mine trolley wire support combining good insulation with high mechanical strength is described. The feature of this insulator is the fact that the suspension pin is anchored within the porcelain by means of an expanding conical shaped head eliminating cement, the expansion being caused by screwing the tubular suspension pin down on an imbedded conical shaped head inserted in the porcelain, thus spreading the pin. J. T. L., JR.

The umbrella type insulator, new transmission high tension line insulator. W. WEICKER. *Elek. Zeits.* [9], 155(1924).—A new type of pin insulator for voltages up to 80 k. v. is described which claims the advantages of a form conforming to the lines of the electrostatic field, can be used on short light pins, has a rugged construction, and also has a great resistance to temperature changes. These insulators are manufactured by Hermsdorf-Schomburg Insulator Co. of Germany in various sizes. J. T. L., JR.

The 1,000,000 v. testing equipment of the Hermsdorf-Schomburg porcelain insulator factory of Freisburg (Sa.). O. NAUMANN. *Elek. Zeits.* [9], 177–80(1924).—The first equipment in Europe for testing up to 1,000,000 v. is described. The plan of the Laboratory as well as app. for testing is shown both by photographs and drawings. Flash-over photographs at 1,000,000 v. on different types of porcelain insulators are reproduced. J. T. L., JR.

The solution of the cement problem in the construction of insulators. ERNEST ROSENTHAL. *Elek. Zeits.* [15], 333–4(1924).—High tension insulator failures are found to be largely due to volume changes in the cement. Changes in design of the insulator so that the stresses due to this change were distributed and not localized gave

considerable improvement in service and in strength tests. Since ordinary Portland cement has a thermal expansion coefficient of four times that of porcelain this was decided to be an important source of trouble. However, when this was compensated for by adding a grog to the cement which gave it an expansion coefficient equal to that of porcelain no better results were obtained. Curves are given showing volume changes in cement over a long length of time and it is concluded that moisture absorption of the cement is the controlling factor. By means of adding a pitch composition (Pechsmelzkopern) to the cement and heating to a relatively high temperature, the pores of the cement are closed and moisture absorption and consequent volume change are eliminated. J. T. L., Jr.

Laboratory watch glasses of porcelain. H. Kreis. *Schweiz. Apoth. Ztg.*, **61,** 594(1924).—Watch glasses of white or black porcelain, the manuf. of which K. had suggested for use in special reactions, are now obtainable. S. W. (*C. A.*)

Industrial filtration. I. British chamber and frame presses. S. G. Ure. *Chemistry and Industry*, **43,** 136–41(1924).—In this survey the following are dealt with: (1) types of plates, (2) washing the cake, (3) drying the cake, (4) filter cloths, (5) filter aids, (6) closing devices, (7) materials of construction, (8) number of chambers, (9) feeding the filter press. The article is illustrated with 9 cuts of presses and parts. E. G. R. (*C. A.*)

PATENT

Acid-proof cement lining for digesters of sulphite pulp. Naoki Takata. U. S. 1,492,866, May 6. The method of making an acid proof, rapid setting cement ingredient for use in lining a sulphite pulp digester, consisting in mixing substantially 60 parts of white clay, substantially 10 parts of lime, substantially 3 parts of asbestos and substantially 6 parts of borax, heating such mixture, powdering the product after cooling, and admixing the same with substantially 10 parts of lead oxide powder.

Equipment and Apparatus

Peripheral-discharge cylindrical mills. A. W. Allen. *Eng. Min. Jour.-Press*, **117,** 325–8(1924).—Many designs have been made for ball and tube mills using perforated linings, with outer, fine screens, arranged to screen out and discharge the fines and return the oversize to the interior compartment of the mill for further grinding. Some of these mills have been fairly successful, but difficulties, such as clogging and excessive wear of screens and liners have narrowed their field of usefulness. The chief disadvantage in such designs is that holes or slots cause weakening of the lining and direct contact with balls tends to cause burring and clogging of the openings. An important recent development is embodied in the Forrester-Rexman rod mill, in which the rods are cradled at two points on cast spiders and do not touch the perforated lining at all. The rods are divided into four separate bunches by four compartments in the supporting spiders. A trunnion-extension scoop picks up the feed, together with water, if wet grinding is practiced, and the material falls onto the rods which roll together, supported at two points by the spider liners. The revolving mill causes the usual abrading action between the rods. The crushed material falls onto the bottom of the mill and passes through the coarse-screen lining, onto a fine screen around the outside. Oversize from the fine screen passes back into the inner compartments by special openings. The rods wear no more at the two cradle supports than at other points. Clogging and wear of screens are much lessened by this design. B. M. L.

Dust control in crushing plants important. G. E. Lynch. *Eng. Min. Jour.-Press*, **117,** 165–7(1924).—The control of dust is nearly always a profitable investment. It always improves working conditions, with increased efficiency of labor and reduced turnover. Very often valuable material is recovered in dust collection. In crushing

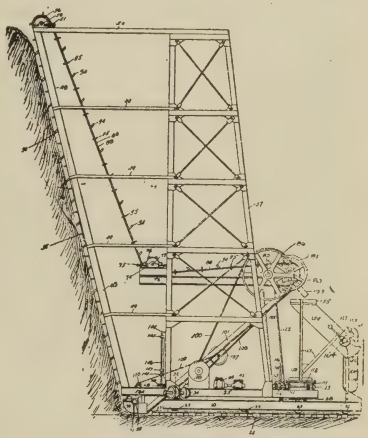
plants and others producing large amounts, dusting should first be reduced to the lowest possible min. and then equipment provided for collection of dust unavoidably produced. Study of air currents, ventilation and design of dust collecting equipment are discussed.

B. M. L.

A contribution to the thermodynamics of drying. F. MERKEL. *Z. Ver. deut. Ing.*, **67**, 81–4, 106–8(1923).—By means of the principles of thermodynamics, involving a large amt. of mathematics, diagrams are developed for detg. directly the *heat consumed and the thermal efficiency of drying processes.* Such a method can also be applied to heat exchange in general, such as the *humidifying of air, cooling by evapn.*, the *vaporization of liquid fuels* and the *drying of air by cooling.* C. C. D. (*C. A.*)

PATENT

Excavating machine. THEODORE AULMANN. U. S. 1,492,060, April 29. In a device of the class described, a platform, a movable frame on said platform, an excavator member on said frame, capable of moving downwardly to the floor line to loosen the material to be excavated, then upwardly to deliver it to a hopper, means for moving said excavator member transversely in either direction, pivoted gathering means for each side of said excavator member, adjacent to the floor, and means for alternately raising and lowering said gathering means.



Kilns, Furnaces, Fuels and Combustion

Sulphur as an index to ash fusibility. J. A. MURRAY. *Power*, **59** [15], 561(1924).—From the results of 1163 detn. made at the Detroit Edison Co. it appears that there is a marked relation between the sulphur content of coals and the softening temp. of its ash. Although sulphur, in itself, is not the cause of low fusibility, but rather the iron, it appears that the percentage of iron as Fe_2O_3 in coal usually varies with the percentage of sulphur. C. J. H.

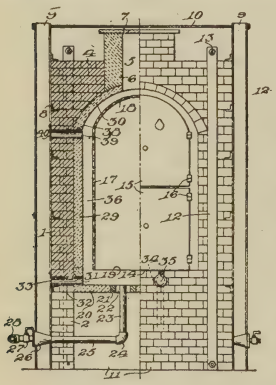
Coal shortage. ANON. *Keram. Rund.*, **32**, 164(1924).—The present coal shortage has proved fortunate to the porcelain industry since it has stimulated the investigation of more economical firing methods which has resulted in a reduction of fuel cost of about $^1/_5$ below that of the prewar cost. German porcelain is made of domestic kaolin and Norwegian quartz and feldspar. Investigations of kaolin washings have shown that the materials washed from the kaolins in some cases were more valuable than the kaolin itself. This sediment was found to contain radium and is now being used as a source of the mineral. Slag from blast furnaces which was formerly thrown away is now made into Portland cement. Fine minerals are found in the sediment of kaolin washings which produce a porcelain-like body at cones 14 to 16. It is suggested that this material be used as a substitute for Norwegian feldspar. H. G. S.

The utilization of waste heat in the ceramic industry. OTTO BRANDT. *Tonind.-Ztg.*, **48**, 190–2(1924).—Methods are described for utilizing the waste heat of rotary cement kilns for firing boilers. Installations are also described for utilizing the waste heat from ceramic kilns for firing boilers and drying ware. H. G. S.

The firing of porcelain by means of masut. ALBERT GRANGER. *Céramique*, **25**, 167–70(1922).—Experiments were conducted to det. the value of masut as a fuel for firing ceramic wares. G. concludes that masut would make a good substitute for wood in firing porcelain. The advantages claimed for masut as compared with wood are:

greater flexibility, good control of the kiln atmos., and greater economy. It is especially suitable for firing to high temps. H. G. S.

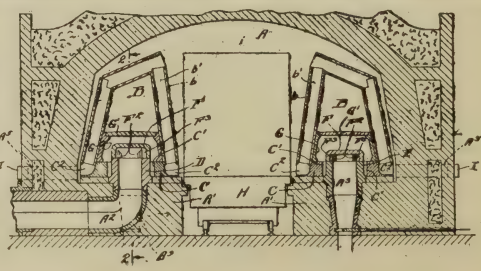
Loss of heat from furnace walls. ROBERT CALVERT AND LYLE CALDWELL. *Ind. Eng. Chem.*, **16** [5], 483(1924).—The authors call attention to the probable cost of ht. waste in U. S. industry and point out methods of reducing these losses. Method for detg. ht. condy. of various ht. insulating mats., with formulae and sample calcns., is given. Effect of varying size of pore spaces in ht. insulating efficiencies from work of Mellor is carried through to the work of Kreisinger and Ray, proving futility of so-called "dead air" space in fur. walls as ht. insulator. Firmness of bonding and differences in "hard burned" and softer, or unburned, insulating brick are noted. Data for various insulators and refractories show that a layer 0.5 in. to 1.5 in. thick, of the various insulators, has an insulating value approx. equiv. to 9 in. of fire brick or silica brick. The thermal condy. of insulators varies with the temp. of use, the density, unevenness of distribution of pore spaces, the temp. to which the mat. has been subjected during manuf. and, possibly, with the elasticity. Temp. gradients through the walls follow roughly the slopes calcd. from the thermal conductivities. The surface emissivity of a wall, as affected by its color, texture or compn., is probably a small factor in ht. losses from high temp. fur. The adjustments of temp. undergone by the outer face of the wall, in order to emit to the air the varying ht. transmitted to its surface, are so small as not to make any appreciable change in the temp. gradient between the outer and inner faces of the wall and it is this gradient that dets. the ht. loss. The need of insulation for the efficient opern. of a fur., increases with an increase in fur. temp. A list of some of the valuable contributions already made to the field of ht. economy, concludes the article. R. D. L.



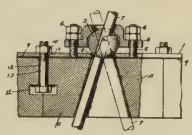
PATENTS

Gas-burning kiln. JOHN W. SNOW. U. S. 1,493,944, May 13. A kiln, comprising the combination of side walls, a tile-inclosed chamber within and spaced from said side walls to provide flues between said chamber and side walls, said chamber being open at the bottom, a horizontally extending partition beneath said chamber and provided with an enlarged aperture, fuel-gas-and-air mixing means extending freely through said aperture to direct a flame towards said chamber, and an aperture provided in one of the side walls to admit additional air to pass through said partition apertures and unite with the gas and air mixture above said partition in the region of the flame.

Burner for furnaces. PHILIP D'HUC DRESSLER and LUTHER T. STROMMER. U. S. 1,491,587, April 22. The combination with a combustion chamber, of means for passing combustible gas into said chamber comprising a gas supply conduit extending into the combustion chamber and having an elbow bend at its discharge end, and means for causing a decarbonizing fluid stream to flow along the outer or concave side of the internal surface of said elbow bend, and means for supplying air to said chamber for the combustion of gas supplied thereto by said conduit.



Poke ball for gas producers. ALBERT L. GALUSHA. U. S. 1,491,795, Apr. 22. In combination with a fire-box or chamber of a gas producer of the kind described and having holes in its top, of perforated metal poke balls covering said holes, caps securing the balls loosely in position and attached to the top of the fire-box by oppositely placed bolts, and lugs or projections at points on the under side of said caps of a length slightly less than the distance between the cap and the top of the fire-box.



Geology

The mineralogy of the feldspars. II. HAROLD L. ALLING. *Jour. Geol.*, **31** [3], 282–305(1923).—Thermal diagrams of the potash-soda series of feldspars are presented. The binary system of leucite, KAl, Si_2O_6 and SiO_2 is given. Dimorphism of orthoclase-microcline, albite and "barbierite" is discussed. Eighteen photomicrographs of feldspars are shown. Important discoveries have been made on adularia moonstone and sanidine by means of the X-ray spectroscope. (To be continued.)

T. N. McV.

The final consolidation phenomena in the crystallization of igneous rock. R. J. COLONY. *Jour. Geol.*, **31** [3], 169–78(1923).—Pyrogenetic processes are classified: (*a*) effects produced within the igneous rock mass itself, and (*b*) effects produced by the end stage consolidation products upon the neighboring rocks into which these matters have been forced. The effects produced within the igneous rocks are due to molecular changes in the various minerals which crystallize during consolidation, in part to actual reactions occurring between minerals already crystallized and the magma, and in part to reactions between the extreme end stage products of crystallization, and the almost consolidated rocks. Twelve photomicrographs illustrate very clearly the various changes that have taken place. T. N. McV.

The physical chemistry of the crystallization and magmatic differentiation of igneous rocks. J. H. L. VOGT. *Jour. Geol.*, **31** [3], 233–52(1923).—The viscosity of various silicate melts at the same temp. and press. greatly vary. Viscosity decreases as temp. increases. A very good discussion is given of the effects of various oxides upon the viscosity of slags. Orthoclase (or microcline) and albite are characterized by extremely high viscosity just above the melting point. Microcline is very viscous several hundred degrees above the melting point. Anorthite above the melting point has medium viscosity. The melts between albite and anorthite show intermediate viscosity. Melted SiO_2 is extremely viscid. All silicate melts above 60% SiO_2 show increasing viscosity. The viscosity that characterizes a complex silicate may be derived from the viscosity which is characteristic of each component. If it is desired to obtain correct ideas as to the size of minerals crystallizing large molten masses must be used. Minerals of low viscosity crystallize faster than those of high viscosity. Compositions in the neighborhood of eutectics further the formation of glass. Two of the important factors of crystallization are time and viscosity. A comprehensive discussion is given on the equilibrium between the solid and liquid phase of mixed crystal components as applied to the formation of plagioclase. T. N. McV.

The coloring of smoky quartz. B. L. VANZETTI. *Gazz. Chim.*, **54,** 95(1924).—Analytical methods were used to find the colorant and thought to be due to a trace of Mn, Ti and C. The theorized methods, to be due to soln. of colloidal Au. The crystals then studied petrograpically and conclusions arrived at were that this might be due to some dissociated Si and inclusion in formation of the crystals giving a chromatic effect. Illustrations of the petrographic slides are shown. S. S. C.

Chemistry and Physics

Effect of long grinding on quartz (silver sand). R. C. RAY. *Roy. Soc. Proc.*, **102**, 640–2(1923); *Sci. Abst.*, 2522(1923).—It has previously been shown from detn. of the heats of solution that when quartz is subjected to grinding for a long time in a mech. operated agate mortar it partially loses its cryst. structure and is converted into the vitreous state (abst. 385, 1923). The diff. between the mol. hts. of soln. of quartz and vitreous silica indicated that 31.2% of the mat. is converted into the vitreous state by 15 hrs. grinding. The expts. described in the present paper were undertaken to test the suggestion that a measurement of the d. of the ground and unground mat. ought to show a diff. if any considerable change takes place. It is found that the d. of the ground subs. is lower than that of the unground. The fall of d. shows that as much as 25.7% of the mat. is converted from the cryst. to the vit. state after 15 hrs. grinding. This value agrees fairly well with that arrived at from detn. of the mol. hts. of soln. A. F. G.

The product of the dehydration of kaolin. V. AGAFONOFF AND W. VERNADSKY. *Comptes Rendus*, **178** [13], 1082–4(1924).—There are 2 viewpoints on the product of kaolin dehydrated between 450° and 550°C. (1) A mechanical mixt. of Al_2O_3 and SiO_2. (2) A homogeneous body of the compn. $Al_2Si_2O_7$. The expt. made places the homogeneity out of doubt. (*a*) A study of white kaolin from Algeria showed a homogeneous appearance of shining particles under the microscope. The anal. is SiO_2—46.65, Al_2O_3—40.17, Ignition—14.0. The theoretical is SiO_2—46.5, $H_2Al_2Si_2O_8H_2O$—39.5, Ignition—14.0. The product of dehydration was obtained in an elec. fur. between 450° and 550°C. (*b*) The d. of the powders detd. in bromoform was kaolin—2.58–2.59, the dehydrated kaolin 2.32–2.38. These powders are perfectly homogeneous in liquids. An artificial mixt. of Al_2O_3 and SiO_2 powdered after htg. to 550–600° is hetereogeneous and the SiO_2 floats while the Al_2O_3 sinks in bromoform of d. 2.75. (*c*) The product of dehydration is homogeneous under the microscope. The htg. does not sensibly change the appearance of the powdered kaolin. The index of refraction is kaolin 1.555 and the dehydrated kaolin 1.513. (*d*) The powdered kaolin and its product both take an intense coloration in methylene blue soln. and are homogeneous while the artificial mixt. so treated remains heterogeneous. The SiO_2 takes no color while the Al_2O_3 becomes colored. (*e*) The conclusion is that after ignition at 550°C, the kaolin gives a homogeneous product $Al_2Si_2O_7$. The decompn. into Al_2O_3 and SiO_2 does not take place. The product $Al_2Si_2O_7$ thus obtained is sol. in acids. W. R. K.

Action of heat on kaolins, clays, etc. A. BIGOT. *Comptes Rendus*, **176** [2], 91–3(1923).—Tests were made on a number of ceramic mats. to det. the effect of heat on the colloids. The mats. were dried, ground to pass a No. 200 silk screen. Two series of test pieces were prepd. (1) Soft plastic condition; (2) Semi-dry powder moistened with 4 to 8% water and compressed at about 375–400 kg./sq. cm. These were htd. at different temps., some being reground after successive htgs. and the decrease in plasticity noted. The conclusions are: Plastic ceramic mat. under the action of heat, undergo a hardening, without dehydration or vol. change; this hardening comes from a partial pectization of the colloids. After dehydration and above 700°C a phys. change occurs, accompanied by shrinkage, and the mat. becomes harder, at the same time the colloids are destroyed. Non-plastic mat. hardens at about 1000°C after complete dehydration which has taken place around 650–700°C. The phenomenon of pectization plays a considerable part in ceram. W. R. K.

Fused kaolins and bauxites. A. BIGOT. *Comptes Rendus*, **178** [6], 569–71 (1924).—The note starts a study of the chem. transformation of kaolin and bauxites by fusion. The fused product does not devitrify easily at elevated temp. as is the case

with fused SiO_2. Four photomicrographs are given as illustrations. A white bauxite "A" containing 21% SiO_2 htd. to 1710°C starts to undergo a transformation. The figure shows nodules without clear cut crystn. The same "A" heated above 1900° changes to a crystn. mass composed of sillimanite $SiO_2Al_2O_3$ and corundum Al_2O_3. The figure shows well defined crystals. A red bauxite "B" low in SiO_2 and high in iron fuses below 1700° and changes to crystals of corundum which appear distributed in a black magma. A kaolin "C" heated above 1800° changed to a cryst. mass of sillimanite in a vitreous medium. The anal. are:

	"A"	"B"	"C"
SiO_2	21.55	3.33	53.91
Al_2O_3	69.15	69.20	43.95
Fe_2O_3	3.41	21.18	0.59
TiO_2	5.69	4.65	0.59
CaOMgO	0.48	0.75	0.48
Alks.	0.13	0.18	0.65

If we suppose the SiO_2 in "A" to be combined at the moment of fusion with enough Al_2O_3 to go completely to sillimanite, there is formed 58.2% sillimanite and 32.6% Al_2O_3 remains of which a part crystallizes, while the rest combines with other elements forming the amorphous body. It is possible that the amorphous mass contains SiO_2, for nothing proves all the SiO_2 has been changed to sillimanite. "A" has had its full shrinkage in fusing. It is refractory, abrasive and very resistant to phys. and chem. action. Its application is in refrac. products. The crystals formed when "B" is fused are more abrasive than "A" and are used as an abrasive. "C" is as refrac. and abrasive as "A" but has no industrial application. If we suppose that all the Al_2O_3 of the fused "C" is combined with the SiO_2 we find 69.81% sillimanite and 28.05% fused SiO_2 which is combined with the other elements. It is probable that all the Al_2O_3 has not crystd. and part stays combined with the vitreous SiO_2. The transformation into sillimanite at high temp. has an application of particular interest to porcelain insulator manuf. where the insulators are used for the support of wires carrying high voltage and high frequency. It is observed that the presence of these needle-like crystals increases to a great degree the resist. to rupture under the action of sparking. The authors are further researching to observe how kaolin behaves when known proportions of Al_2O_3 and SiO_2 are added before fusion. W. R. K.

Rapid method for determination of potassium. M. Bulli and L. Fernandez. *Giorn. Chim. Ind. ed App.*, **6**, 60(1924).—The method is adapted for K in sol. Using 50 cc. of sol., 5 gr. of $Pb(NO_3)_2$ are added to ppt. SO_4, CO_3. To filt. 15 gr. of $NaNO_2$ are added forming $NaPb(NO_2)_3$. 2–3 cc. of $Co(NO_3)_2$ is then added forming $PbK_2[Co(NO_2)_6]$ which is pptd. out as microcrystals. The crystals are collected in a Gooch crucible and then dissolved in 50 cc. of $N/10$ $KMnO_4$ and 1 cc. of dil. H_2SO_4 and after a half hour 2–3 cc. of H_2SO_4 added. The excess of $KMnO_4$ is titrated out with $N/20$ $Na_2C_2O_4$ and the total no. of cc. of $KMnO_4$ used in ppt. is multiplied by the factor 0.0006517 giving the value for K in gr. This method was used on several types of products and a good check value obtained. S. S. C.

On Seger cones. Ryoichi Shigemune. *J. Jap. Cer. Assoc.*, **32** [374,] 41–4 (1924).—A short historical survey on the manuf. of Seger cones in Germany, U. S. A. and Japan is given. Then, the works of H. A. Seger, H. Hecht, M. Simonis and Shepherd-Rankin on the relation between their m. p. and chem. or mineral compns., as well as those of Robert B. Sosman and Hoffmann-Meissner on the effect of htg. time upon their m. p. are discussed. In conclusion, the author urges the specif. of their manuf. in the country. S. K.

Oxidase reaction of Japanese acid clay, fuller's earth, and Florida earth. KYUHEI KOBAYASHI AND KEN-ICHI YAMAMOTO. *J. Chem. Ind.* (Japan), **26,** 289–96(1923).—Japanese acid clays, fuller's earth, and Florida earth, but not kaolin, kieselguhr, or volcanic ash, give the oxidase reaction with an alc. soln. of guaiacum, and with other substances. It is supposed that the so-called Helmholtz double layer is formed around the surface of the clay when suspended in water and that it absorbs hydroxyl ions, H ions being liberated near the surface. The hydroxyl ions thus absorbed combine directly, liberating 1 atom of O and forming water. This active atom of O may act on oxidizable reagents and give the oxidase reaction. J. C. S. (*C. A.*)

Alumosilicates. V. VERNADSKII. *Brit. Assoc. Adv. Sci. Rept.*, **1923,** 435–6.—Alumosilicates are divided into *anhydrides* (Al_2SiO_5, $Al_2SiO_4F_2$, etc.), *acids* ($H_2Al_2Si_2O_8.H_2O$, $H_2Al_2Si_4O_{12}$, etc.) and *salts* ($K_2Al_2Si_6O_{16}$, etc.), all of which can form *addn. products* ($3CaAl_2Si_2O_8.Ca(OH)_2$, $CaAl_2Si_2O_2O_8.Ca_2SiO_4$, etc.) where the aluminosilicate group dominates the properties. The salts and their addn. products can be divided in 3 groups: (1) *sillimanite salts* of the acid $H_2Al_2SiO_6$ and their addn. products (chloritoids); (2) *leverrierite salts* of the acids $H_2Al_2Si_{2+n}O_{8+2n}$ where $n = 0, 2, 4, 6, 8$ ($K_2Al_2Si_2O_8$, $K_2Al_2Si_4O_{12}$, etc.), whose addn. products have the general formula $pAqB$ where A = aluminosilicate, B = group of elements of secondary importance, $p = 1, 2, 3 \ldots$ and $q = 1$ or 2 (all compds. have a *chromogene constitution*, a *common nucleus* $M_2Al_2Si_2O_8$, give *clays on weathering* and are obtained by natural and synthetic reactions from kaolinite) and which are represented by zeolites, feldspars, nephelines, garnets, epidote, scapolites, etc., and (3) *salts of polybasic acids of the anhydrides* Al_2SiO_5, $Al_2Si_2O_7 \ldots$ (chlorites), including mostly hydrated Mg and Fe compds. Melilites, polygorsaites, etc., do not belong to the aluminosilicates. C. C. D. (*C. A.*)

The use of measuring vessels at temperatures varying from the normal. G. BRUHNS. *Z. angew. Chem.*, **37,** 51–2(1924).—The vol. of the Mohr l. depends entirely upon the temp. at which this unit is measured, while the normal l. is independent of the temp. The expansion of the glass vessel and of the liquid contained in it are compensating errors, and the total error in the use of graduated flasks at temps. other than the normal is thus reduced to a small figure. T. S. C. (*C. A.*)

BOOK

GARDNER, WM.: **Chemical Synonyms and Trade Names.** London: Crosby Lockwood and Son. 25s. net. Reviewed in *Chem. Trade J.*, **74,** 172(1924). (*C. A.*)

PATENT

Water glass and its process of production. LOUIS SCHNEIDER. U. S. 1,493,708, May 13. The process of making water glass by mixing in a dry state caustic soda with an incompletely dehydrated-silicic-acid-hydro-gel and subsequently adding water to produce the desired concentration.

General

Making long life molds. *Foundry,* **52** [8], 294–7(1924).—Various mixt. for making semi-permanent molds are given, with results obtained from them in fdry. tests. Molds made of fused alumina, mixed to a paste with water, gave good results on medium sized gray iron castings. Molds made of zircon showed an effective saving over the ordinary sand mold. M. E. M.

The combustion of fuel in dust form. A. B. HELBIG. *Feuerungstechnik,* **12** [11], 86(1924).—Attempts to increase burning efficiency and approach the highest temperatures theoretically possible with various fuels under ideal conditions have so far been hampered owing to the lack of a suitable refractory for furnace linings. The softening point of clay fire brick is given as from 1200–1400°C, and of silica brick 1600–1650°C followed by very rapid softening above this temperature. Magnesite brick

start to soften at 1500°C but very gradually so that at 1700° they still have some resistance long after silica brick have melted down. This has lead to the development of the Delbag pressure furnace the side walls of which are built of refractory brick perforated with very fine holes (4200 per sq. m.). The entire furnace is surrounded by an air jacket under slight static pressure ($^3/_8$–2″ water). Pulverized fuel, oil or gas are introduced into the furnace with just sufficient air for suspension of the particles, the balance of the air for combustion being introduced through the pinholes in the walls. Advantages claimed are: (1) Brick lining cooled below softening point; (2) Layer of air covering surface of brick protects them from deposit of products of combustion; (3) Incoming air is preheated as it passes through the brick in a thin stream and combustion is extremely rapid on entering furnace; (4) Losses through radiation and conduction extremely low on account of air film covering furnace walls. With this furnace continuous temperatures considerably over 1700°C have been reached.

F. A. W.

The constitution of basic slags:—Its relation to furnace reactions. T. P. Colclough. *Jour. Iron Steel Inst.*, **107,** 267(1923).—Author gives plain statement of facts with data to support them, which should be useful to workers in ferrous alloys especially steels. Principle adopted in the tests in this investg. was to study the effect of slags of diff. compn. on the impure metal of the bath and, by studying the relative rates of elimination of the various elements, to form a concept of the reactions which occur and of the nature of the products formed. Tests carried on in 50 to 60 ton capacity open-hearth furnaces using mixtures of scrap and hot metal from an "active" mixer. Limestone added with the charge in all cases, in some cases no oxide was added until the desired type of slag had been obtained, some time after the charge was melted. The conclusions arrived at are given as follows: (1) Slag formed in a basic open-hearth furnace is essentially tetra-calcic-phosphate of lime with monosilicate of lime, magnesia and manganese oxide. (2) Additions of acid "oxides to such slag causes instability and leads to a return of phosphorus to the metal." (3) Additions of basic oxides merely pass into solution and type of compound is not altered. In certain cases there is probably a compound of lime and ferric oxide formed which is comparatively stable. (4) When an excess of lime is present, MnO is carried into solution and, under certain conditions, is reducible to manganese. (5) The relative rates of oxidation of carbon and phosphorus depend primarily on the basicity of the slag, and there are two critical compositions: (*a*) When the total bases are sufficient only to form the slag given in (1) there is no further oxidation of phosphorus, and carbon is eliminated. (*b*) When the lime content is sufficient to form the silicate and phosphate, carbon remains constant until nearly all the phos. is eliminated. (6) The removal of sulphur is only indirectly due to the presence of a high lime content—the direct agent is manganese, which is thrown into the bath from the slag.

H. G. W.

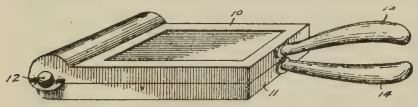
Clay industry in Saskatchewan. E. L. Chicanot. *Eng. & Min. Jour.-Press*, **116,** 107–8(1923).—The province of Saskatchewan, Canada, has a healthy and growing clay-products industry. Imports of such products into Canada in the last year were valued at $6,778,365 about half of which came from the United Kingdom, and slightly less from the U. S. Exports have been negligible, the Canadian products being intended almost entirely for domestic market, and were valued at $8,335,900 in 1921. Brick, tile and earthenware clays, refractory clays and ball clays burning nearly white have been found in Canada, Saskatchewan having a large share of these. Recently a large deposit of china clay has been located in Saskatchewan and plans are in prospect for a plant to produce chinaware and electrical insulators. A course in ceramic engineering has been instituted in the University of Saskatchewan to insure a supply of technical experts for the growing ceramic industry.

B. M. L.

The non-metallic minerals and chemicals used in the pulp and paper industry. L. H. Cole. *Can. Min. Jour.*, **45**, 158–60, 236–9 and 258–61(1924).—This series of three articles gives a very complete review of all the non-metallics used in the equipment, process and products of pulp and paper manufacture. Necessary properties and important specif. are given, and Canadian sources of these materials (such as sandstone, clays, soapstone, silica sand, asbestos, limestone, magnesite, talc, etc.) are discussed. B. M. L.

PATENT

Ceramic product. John Schumacher. U. S. 1,492,753, May 6. The process of making a ceramic product comprising mixing silica and water glass to form a plastic substance, placing the plastic substance in a mold, and baking said substance in the mold to the fusing point of said substance.



BOOK REVIEWS

Archaeologist and Potter. The pottery produced by the Greeks has afforded a fascinating field of study for a long period of years. Probably no phase of ceramics has proved more fruitful as to its bearing upon history and art. The extent of existing collections and the great variety of examples, extending as they do over many centuries of production, have emphasized the importance of this source and while the evolution of method and style has been exhaustively studied it has been for the most part without accurate technical knowledge on the part of the investigators. The author of the work under review[1] says in her preface, "The neglect of this highly valuable source of information (the practical knowledge of pottery) has led to some surprising theories regarding the technique of Greek vases; and these theories have been repeated over and over again in our books on vases, for the simple reason that, not having any first hand knowledge, we have copied these statements from one another."

Thus Miss Richter has had the courage to acknowledge the situation and to place herself in the position of a beginner in the art of the potter. Her recently published book is the outcome of this endeavor and she has certainly succeeded in placing the work of the Grecian potters in a new light.

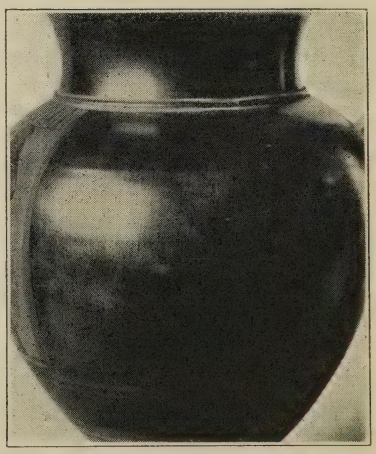


Fig. 1.—Greek vase with turned surface and marks of turning tools.

Miss Richter joined the summer school of pottery at Alfred, New York, during two successive seasons and learned how to make, with her own hands, vases similar to the Greek. (Fig. 1.) Her most important contributions to this study are two: first the demonstration that the Greek vases were turned

[1] "The Craft of Athenian Pottery" by Gisela M. A. Richter, New York, Metropolitan Museum of Art, 1923.

on the wheel after being shaped and when they had reached the "leather hard" condition; and second, the fact, previously suggested by one of the German investigators, but not hitherto proved, that the Greek wares were fired only once (Fig. 2).

In addition to the interesting and comprehensive explanation of processes the book contains numerous contemporary illustrations of Grecian potters at work. Some of the actions noted are now for the first time satisfactorily described and explained and finally the closing pages are occupied with the most complete series of classical extracts on pottery that has ever been published. This in itself is a valuable contribution to ceramic literature and will be valued by those who see in clay something more than a possible brick or dish. That the ancients were sensible of the close connection between plastic clay and humanity is quite evident from several of the quotations, as for instance this from Plato given on page 92.

Fig. 2.—Drawing showing interior of Greek kiln.

"Is not this, as they say, to learn the potter's craft by undertaking a pithos (that is a large jar) and does not this seem to you a foolish thing to do?"

Charles F. Binns.

The Coal Formation Clays of Ohio. Fourth Series, Bulletin 26, Geological Survey of Ohio, in coöperation with The United States Bureau of Mines. By Wilbur Stout, R. T. Stull, Wm. J. McCaughey, and D. J. Demorest. 1923. 588 pages. Price, $1.50, net.

A very complete text covering the history of the clay industries in Ohio; the stratigraphy and distribution of the coal formation clays of Ohio, their mineral and chemical composition, their physical properties, including firing behavior data and a complete analytical table covering the essential properties; the methods used in the microscopic analyses, the chemical analyses and the laboratory tests of the clays; the listing and description of the accessory minerals, their behavior during firing and a new theory of the Origin of Coal Formation Clays.

The book is furnished with a complete index and table of contents which enhance its value as a reference volume. The text is in chapter form and is briefly reviewed as follows:

Chapter 1.—History of the Clay Industry in Ohio, by W. Stout.—A brief history of the different types of ceramic wares manufactured including the names and locations of the various companies, the names of their respective founders, the dates organized, the sources of supply of raw materials, and the history of the various organizations down to the present time, together with a number of interesting plates of plants. Also a history of the first School of Ceramics in the United States.

Chapter II.—Coal Formation Clays of Ohio, by W. Stout, R. T. Stull, Wm. J. McCaughey, and D. J. Demorest.—A thorough treatise covering the stratigraphy, distribution and properties of the principal clay and coal-bearing horizons found in the various formations. This chapter constitutes the major portion of the volume and the material covered in it might well be considered the occasion for the publication.

Sections of the different formations are shown including the general description and thickness of the various members which are considered in ascending order. The distribution of the members is described by counties and townships. The economic value of each member is also given.

The factories in the field are noted together with the clays employed, the ware produced, and the plant capacity. A map is included showing the locations of the

various formations, the plants where samples have been taken, and the plants in operation.

Complete chemical analyses, including sulphur, total carbon and inorganic carbon, are given for the various clays. These analyses are the most complete and among the most accurate that have been made on coal formation clays. The percentage oxide ratio for each clay is also given, having the molecular equivalent of Al_2O_3 figured as unity.

The mineral compositions as determined by microscopic examination, are given for the most important clays. This constitutes the most important mineralogical work that has been done on coal formation clays. The range covered is from the purest to the most impure clay.

For the various clays are given results of physical tests including working properties and drying shrinkage; their complete firing behavior data including shrinkage, both linear and volume, volume absorption and color over a wide range of firing temperatures. The overfiring temperature, the best apparent burning range, the deformation temperature and the commercial possibilities are also given. These data as given should be of particular interest to ceramic men.

A very complete Analytical Table of the Coal Formation Clays of Ohio is included which should be especially valuable for ready reference. The chemical analysis and the majority of the properties above listed are found in this table.

A number of interesting plates, plants and mines are also shown.

Chapter III.—Testing of Clays, by R. T. Stull.—An explanation of the various steps employed and a definition of the expressions encountered in the thorough testing of clays.

The complete method of procedure used in making the tests on the Coal Formation Clays is outlined.

A classification of Coal Formation Clays is given according to their refractoriness as indicated by their deformation temperatures. A Classification of clay fire brick is also given.

There is also a very thorough explanation of the relation of the $RO\text{-}SiO_2$ content to refractoriness together with a figure on which the various clays tested are located according to their $RO\text{-}SiO_2$ content with their refractoriness indicated by a legend and zonal curve.

Chapter IV.—Influence of Minerals and Mineral Components in Clays, by W. Stout.—A description of accessory minerals and impurities common to Coal Formation Clays and the secondary compounds formed from them, and their effect on the firing behavior of the clays.

The change which firing produces in clays is thorougly covered by excerpts from a former Ohio Geological Survey Bulletin written by Edward Orton, Jr.

Chapter V.—Mineralogical Examination of Coal Formation Clays, by Wm. J. McCaughey.—A valuation of the microscopic examination of a clay to determine its mineral composition which in turn will disclose the nature and distribution of the "impurities" of the clay.

A complete method of procedure is given for the necessary preliminary treatment of clays for microscopic examination. Oil immersion methods as used in the microscopic examination of clays is also described.

The accessory minerals of the Ohio Coal Formation Clays as determined microscopically are listed in the order of their abundance. The manner in which each mineral occurs is then described in detail. The clays examined are classified according to their accessory mineral contents.

Chapter VI.—Chemical Analysis of Clays, by D. J. Demorest. The complete method of procedure for making the chemical analysis of clays as followed in the analyses of the Coal Formation Clays of Ohio.

A list of constituents is also given which are liable to occur in natural silicates.

Chapter VII.—Origin of Coal Formation Clays, by W. Stout.—A new theory for the origin of Coal Formation Clays.

Many of the relationships of clay to coal are explained to substantiate the theory, as for example, the relation in composition of clay to coal ash. In general, the geological, chemical and physical features of coal formation clays are explained by this theory in a satisfactory manner.

The order of deposition under marine conditions of coal formation strata is shown in a figure.

PERRY D. HELSER

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[1] The abbreviation (*C. A.*) at the end of an abstract indicates that the abstract was secured from the Editor of *Chemical Abstracts* by coöperative agreement.

Abrasives

PATENTS

Emery and sand cloth and paper. H. JACKSON. Brit. 208,389, Dec. 27, 1922. Waterproof sand paper, emery cloth, etc., are produced by treating the paper, etc., backing, after coating with glue, gelatin, or similar adhesive and before or after the application of the abrasive material, with alum, tannic acid, HCHO, dichromates, etc. The backing may be coated on one or both sides with the adhesive and abrasive. The backing may be rendered waterproof, at the same time as the adhesive, by the application of sufficient adhesive to impregnate the backing. (*C. A.*)

Adhesives. C. KRUG. Brit. 208,132, Nov. 23, 1923. A cementing or binding compn., particularly suitable for securing abrasive coverings to steel disks, consists of a mixt. of shellac with a substance such as an artificial resin, *e. g.*, a condensation product of phenol and HCHO, which increases its fluidity. The compn. may also contain a hygroscopic mineral such as chalk, heavy spar or pumice and a substance of great heat capacity, *e. g.*, Fe_2O_3. A preferred method of prepn. consists in mixing equal parts of artificial resin, chalk, pumice and Fe_2O_3 and adding the mixt. to rather less than its own wt. of shellac. The product may be melted, stirred, solidified and ground. Cf. 10,374, 1913. (*C. A.*)

Abrasive for grinding and smoothing glass. W. L. KANN. U. S. reissue 15,796, Mar. 18. See original pat. No. 1,387,649, *C. A.*, **15**, 4043. (*C. A.*)

Cement, Lime and Plaster

Calculating the horse power consumed in (cement) ball mills. E. C. BLANC. *Rev. Mat. Constr. Trav. Pub.*, **174**, 57–60(1924).—An empirical formula has been developed whereby the motive power necessary for rotating a ball mill is detd. from its dimensions, the wt. of the charge and a filling coeff., dependent upon the vol. occupied by the charge. The formula is $F = CT\sqrt{D}$, where F is the motive power in H.P., T the total wt. of pebbles, D the interior diameter of the mill, C the filling coeff., which depends upon the kind of pebbles (grinding medium) used, and also upon the filling ratio (ratio of vol. of charge to total (inside) vol. of mill). For cement grinding the values of C are:

Grinding Medium (Filling Ratio)	0.1	0.2	0.3	0.4	0.5
Flint Pebbles	13.3	12.25	11	9.5	7.8
Steel Balls (large) for initial grinding	11.9	11	9.9	8.5	7
Steel Balls (small) for final grinding	11.5	10.6	9.5	8.2	6.8

Example. Mill with 3 compartments. Diam. 1.65 m., length 8.2 m., internal diam. 1.565 m., rev. per min. 25; 1st compartment (1), length 2.775 m., 6 T. large steel balls, filling ratio 0.2; 2nd compartment (2) length 3.50 m., 4 T. flint pebbles, filling ratio 0.37; 3rd compartment (3) length 1.50 m., 6 T. small steel balls, filling ratio 0.45. The H.P. is calcd. for each compartment separately:

$$F_1 = 11 \times 6 \times \sqrt{1.565} + 10\% = 91 \text{ h. p.}$$
$$F_2 = 9.95 \times 4 \times \sqrt{1.565} = 50 \text{ h. p.}$$
$$F_3 = 7.6 \times 6 \times \sqrt{1.565} = 57 \text{ h. p.}$$
$$198 \text{ h. p.}$$

Actual power used 200 h. p. For corrugated (or step) surfaces on the interior, additional 10% h. p. is required as for compartment (1). L. N.

Cement making by the "mixing" process. G. H. *Rev. Mat. Constr. Trav. Pub.*, **176**, 113–6(1924).—In principle the process is as follows: (1) Limestone of known compn.

is burned. (2) To the resulting quicklime the remainder of the necessary raw materials for making the cement is added. These raw materials may consist of clay or shist, and lime in the form of marl, lime sludge or the fines from the crushers. The moist. of the raw mats. added is made sufficient (by additions of water when necessary) to slake the quicklime. (3) After complete slaking the mixt. is ground, and (4) burned. Often the powdered coal used as fuel is added as a part of the raw mats. in operation (2). When inferior coal is used intentionally, consideration is given to the ash content added to the cement. (5) The clinker is ground, and the resulting cement is ready for bagging. It is claimed that the method is economical for the reasons that (*a*) the cost of drying the raw materials is reduced, (*b*) materials otherwise considered waste, as the fines from the crushers can be used, and (3) the cost of the final firing is also materially reduced.

L. N.

Fuel economy in chemical works. C. Elliott and H. W. Hollands. *Chem. Trade Jour. and Chem. Eng.*, **74,** 277(1924).—The use of powdered coal in rotary driers and cement kilns is discussed. The rotary cement kiln is not an economical fuel consumer but is advantageous because it is continuous, saves labor, and yields better clinker. Producer gas may be used successfully in cement kilns and in some industries, and in sodium silicate manuf. is most economical. P. W. K.

Alumina cement in France. Edwin C. Eckel. *Eng. News-Record*, **91** [9], 347–9 (1923).—Alumina cement was invented by Lafarge about 1908 in France. A French patent was issued and the claims read: 1. Process of cement manuf. consisting in melting in a water-jacket or similar furnace a mixt. of bauxite or of mat. primarily aluminous and ferruginous, but relatively little siliceous, with lime, the fused product being then rapidly hardened, then ground and finally pulverized. 2. The industrial product constituted by a cement with a bauxite base or from material primarily aluminous and ferruginous but relatively little siliceous, and lime, the content of lime being defined approx. by the formula $SiO_2 2CaO + Al_2O_3 CaO$. Fifteen years of hard work have changed plant, processes and product so that those of 1908 are no longer recognizable in the modern industry. The European alumina cement industry of today is rather a matter of more or less secret processes than of patents. In France 300,000 bbl. were produced in 1922 and a production of 400,000 to 450,000 is estd. by 1924 which is 7% of the total Port. cement output of France. It is the average opinion of eminent engineers in France, Great Britain and the U. S. that in the next ten years alumina cement could be made and sold to replace from 10 to 20% of the Port. cement output. Alumina cement will always be more expensive than Port. but its use is justified where resistance to action of sea water or alkali waters is a factor and where quicksetting time saves money. There are two large companies in Great Britain contemplating mfg. of alumina cement under separate processes. In Paris today alumina cement costs three times as much as good Port., but repair work on first-class streets and bridges is all done with alumina cement. If the slow and economical French mind can see an advantage under such conditions, it is expected that in due time Detroit, Chicago and New York may also find it profitable to save time at the expense of first cost. F. T. H.

Doubly burned cement. Anon. *Concrete* (Mill Sect.), **24** [4], 57(1924). From *Revue de Materiaux.*—A method of double burning cement, invented by C. Didier, has been in use in France for more than a year with complete satisfaction. The cement produced is superior in quality. The cement-mix is first heated to a temp. just sufficient to drive off all the CO_2. The product is then hydrated, so as to produce an impalpable powder, and the latter is sieved and then burned as usual in a rotary kiln, or it is briquetted and burned in a shaft kiln. The process is advantageous where the limestone is hard and the clay wet so that dry grinding the raw mats. is impracticable. F. T. H.

Atlas Aluminate Cement Company to manufacture alumina cement. Anon.

Concrete, **24** [5], 211(1924).—After months of exptl. mfg., the Atlas Aluminate Cement Co., with main office at 25 Broadway, N. Y. C., has announced that it is now prepd. to produce Lumnite, high alumina cement, at Northampton, Pa., in ample quantities to meet any demand as it develops. F. T. H.

Aluminate cement. HENRY S. SPRACKMAN. *Con. Rec. and Eng. Rev.*, **38**, 401–3 (1924).—Aluminate cement has two exceptional qualities that differentiate it sharply from all other hydraulic binders, namely the rapidity with which it attains max. strength and its perfect resistance to chem. attack by sea water and waters containing sulphate of the alkaline earths in soln. Aluminate cement concrete mixed 1 cement, 2 sand, 4 stone or gravel will give at 24 hrs. a resistance to compressive stress of 2000 lbs. per sq. in.; at 3 days, 5000 lbs.; at 7 days, 6000 lbs. This early strength gives it a great advantage in rapid alteration work. It is considered the cement of the future. O. P. R. O.

Cement works (Tasmania). ANON. *Indus. Australian and Min. Stand.*, **71**, 469(1924).—Tasmania Cement Co. plant is about ready for operation; making cement was the original main object of the enterprise, using oil from the retorting of the shale as fuel. Tests made on the shale oil proved so successful that production of fuel oil, kerosene, and motor spirit is to be of primary importance, waste gases and some of the fuel oil are to be used in firing the cement kiln. Considerable deposits of limestone are available at Railton and it is proposed to use deposits of oil shale from Latrobe as an adjunct to the manuf. of cement. Under this plan of operation, the shale will be treated in a kiln, the oil obtained will be refined, the crudes being used in the manuf. of cement, various by-products will be recovered, and the shale residues will be ground and mixed with the limestone to form cement. The plant will produce 90 T. of cement a day; all the oils, motor spirit, kerosene and fuel oil will be put on the market. The retorts will treat 180 T. of oil shale a day, with an expected yield of 7,200 gal. of distilled oils. A quarter of this and the non-condensable gases will be used in firing the cement kiln, leaving 5,500 gal. of oils for the market. O. P. R. O.

Portland cement. ANON. *Indus. Australian and Min. Standard*, **71**, 434(1924).—Development in the manuf. of Port. cement. The century of a great discovery. The history of the invention, with its developments from time to time; the mixing of raw materials; the wet process and the dry process are described. Calcining and the early types of kiln are discussed; the rotary kiln has done much to revolutionize the industry during the past twenty years. Cooling and grinding are dealt with. This article endeavors to show that Port. cement is a highly scientific product, the manuf. of which is under absolute control from beginning to end and checked at every stage. O. P. R. O.

PATENTS

Cements. A. PETELOT. Brit. 210,760, Jan. 22, 1924. Cements resembling stone, marble and pottery consist of a mixt. of $ZnSO_4$, $BaCl_2$, NH_4Cl, ZnO and SiO_2, with or without limestone. In making the compn., the first three ingredients, dissolved in H_2O, and part of the ZnO are mixed together, evapd. to dryness, and heated to 340°, the remaining ingredients being added after cooling. (*C. A.*)

Bauxite cements. L. G. PATROUILLEAU. Brit. 210,366, July 23, 1923. Cements are obtained by treating a mixt. of lime or limestone and bauxite in a furnace, with the addn. of C to reduce metal oxides. After the first smelting the metallic pig or slag is removed by pouring or sorting, and the remaining alumino-silico-calcic slag is crushed, screened, and passed to a magnetic separator, which preferably comprises an endless band, with magnets so arranged as to allow the non-magnetic particles to drop from the band, while the magnetic particles remain adhering to it. By thus freeing the cement from metallic impurities, a const. proportion of lime, alumina, silica and as an accessory magnesia may be obtained. (*C. A.*)

Hydrating cement. E. P. HALLIBURTON. U. S. 1,486,883, March 18. Cement and liquid, *e. g.* H_2O, are mixed in a vacuum created by the action of a stream of the liquid. (*C. A.*)

Making of cement from blast-furnace slag. W. R. COCHRANE. Brit. 203,963. Blast-fur. slag and carbonate of calcium, chalk or other limestone are all broken to convenient size, pounded and shattered together to an amorphous powder, by means of blows from heavy gravity stamps. The object of this operation is to break down the vitreous structure of the slag by concussion and crushing, more completely and thoroughly than can be effected by any grind process or mere attrition. The finely powdered slag and limestone are floated out of the mortar into a wash mill, where it is kept suspended in water by constant stirring to dissolve and separate out the sol. sulphide of calcium. When sufficiently washed, the whole content of the wash mill are run into settling tanks, and when the solid matter is deposited the superfluous water is run off, carrying away the soluble impurities and leaving the residual slurry of slag and limestone practically free from sulphides. The consolidated slurry of slag and limestone is then removed from the settling tanks and calcined in kilns in the usual way. The resulting clinker is ground to the degree of fineness desired and this completes the process of making an improved cement from blast-furnace slag. *Coll. Guardian*, 1320(1923). O. P. R. O.

Weatherproof coating composition. R. PLÖNNIS. U. S. 1,487,471, Mar. 18. A coating compn. adapted for use on floors and walls is formed of K "water glass" 100, caustic alkali 3, $CaCO_3$ 5 and tar oil 5 parts. (*C. A.*)

Acid-proof binding material. AKTIEBOLAGET SYREFAST. Swed. 55,796, Dec. 11, 1923. A finely divided mixt. of a material contg. orthosilicic acid, PbO or other oxide of Pb, powd. brick, stone and asbestos or other "fat" Mg mineral is stirred up with water glass. (*C. A.*)

Enamel

Rotary spraying booth turns out 720 average pieces of enamelware hourly. INTERVIEW WITH MR. HOGENSON OF THE CHICAGO VITREOUS ENAMEL PROD. CO., CICERO, ILL. *Cer. Ind.*, **2** [6], 353(1924).—The new plant of the Chicago Vitreous Enamel Prod. Co. covers 100,000 sq. ft. of floor space. The equipment in the pickling room includes monel metal baskets, or hoists and individual drying rooms. By the use of baskets the ware is advanced in lots from one tank to another. The steel spray room is equipped with duplex spray booths, each equipped with individual motor and fan. In addition to their own requirements immense quantities of frit mixtures are made for the trade. The frits are tested in actual production before released. The capacity of each frit furnace is 1,000 lbs. of raw material. The smelting is completed in less than 2 hrs. One thousand or more smelts are made before the smelter requires relining. The smelter room is well equipped with app. for the removal of irritating fumes. The frit furnace men are given one week a month off during which time they are employed in less strenuous work. The frit smelters are operated with oil for fuel. The capacity of each smelter is from 12,000 to 22,000 lbs. per 24 hrs. There are two types of continuous sprayers used, the conveyor type and the rotary type. 720 pieces of flat ware are sprayed per hr. in the rotary machine. The minimum production of the cast iron spraying room is 24,000 lbs. every 8 hrs. Portable enamel tanks are used. Separate driers are used for the cast-iron and sheet-iron ware. Waste heat from the furnaces is utilized to heat the driers. The plant was originally equipped with coal-fired furnaces, each having a capacity of 1600 sq. ft. of sheet ware per 24 hrs. The cost of fuel, labor and upkeep was approx. $22 per thousand sq. ft. Intermittent gas-fired furnaces were next installed. Their capacity was also 1600 sq. ft. of sheet ware per 24 hrs. The cost of firing ranged from $26 to $30 per thousand sq. ft The carborundum

muffle type of furnace now in use in connection with the speed fork delivers 3000 to 4000 sq. ft. of sheet ware every 24 hrs. Oil, which is used for fuel, costs $.06 per gallon delivered to the burners. The cost of firing ranges from $3.75 to $5.00 per thousand sq. ft. The cast-iron furnaces have a capacity of 12,000 lbs. of one fired ware every 24 hrs. The cost of firing is approx. $.50 per thousand lbs. Bonuses are paid on all firing work in order to maintain a high standard both in rate of production and quality of ware. The shipping crates have been standardized in order to prevent damage to the ware and to eliminate wrapping. An allowance is given the addressee on returned crates. A sand blast barrel of the direct pressure type is used for cleaning. From 800 to 1500 stove legs are cleaned in this barrel per 8 hr. shift. Hose machines are used on larger pieces. The entire shop is operated with oil for fuel with duplicate equipment. Four 10,000-gallon tanks constitute the oil storage. P. D. H.

The electrolytic removal of dust. J. P. McClaire. *Chem. Trade Jour. and Chem. Eng.*, **74,** 33(1924).—The rusty articles are used as cathodes in a bath contg. NaOH, Na_2CO_3, Na_2SO_4, and NaCN in soln. A current d. of 30 to 140 amp. per sq. ft. causes a rapid evolution of hydrogen, which reduces the rust in a few minutes. The process has been tried successfully on a commercial scale in England for reconditioning war mat. P. W. K.

Falkirk uses new methods. H. C. Estep. *Foundry,* **52** [9], 331–39(1924).—Contains a description, illustd. with photographs, of the application of the Beardsley and Piper Sandslinger to the manuf. of bath tubs, in the plant of M. Cockburn and Co., Falkirk, Scotland. Illus. with photographs. M. E. M.

Enameling cast-iron ware in electric furnaces. H. E. Kennedy. *Chem. Met. Eng.*, **30,** 219–20(1924).—Description of an elec. fur. for enameling bath tubs at the plant of the Pacific Sanitary Co. Ribbon resistors of nickel-chromium were used, embedded in slots in the sides and over the top. After 2 yrs. operation no diminution in cross section was noticeable in the resistor. After the erection of the first fur., 3 duplex fur. were built, which are practically two fur. within a single arch. In these one tub is being preheated while another is being enameled. These stoves take 220 kw. No figures on production are given, but the statement is made that with oil at $1.25 per barrel, the elec. heated tub is slightly cheaper. (Note: This would depend on the power rate, which is not given.) M. E. M.

Heat transfer in enamel-lined apparatus. E. P. Poste. *Ind. Eng. Chem.*, **16** [5], 469(1924).—A report of observations on a wide variety of types of enamel-lined equipment operated under a wide range of conditions. Typical cases are covered on commercial units to illustrate what may be expected under various conditions and from these and other data, the following over-all coefficients of ht. transmission are given:

Over-All Coefficient of Heat Transmission

Conditions	Kg. cal. per hour per sq. M per °C	B.t.u. per hour per sq. ft. per °F
Steam to water being heated	400 to 700	80 to 140
Hot water to water being heated	350	70
Steam to boiling water	700	140
Steam to a thick fruit product	160	32
Cooling water by cold water and by brine	200 to 600	40 to 120
Hot oil to oil being heated	65 to 140	13 to 24
Hot oil to boiling water	150 to 200	30 to 40
Steam to water being heated in tubular heaters	500 to 800	100 to 160
Steam being condensed to water in tubular condenser jacket	700	140

The thickness of the enamel coating, rather than the metal thickness, seems to be the detg. factor in the over-all coeff. of ht. transmission. The values stated are based on actual operg. conditions. R. D. L.

PATENTS

Zirconium oxide concentrate and method of producing the same. CHARLES J. KINZIE. U. S. 1,494,426, June 3. In the derivation of zirconium oxide from mat. composed of compds. of zirconium associated with undesired sub., the steps which consist in mixing and htg. said mat. with sulphuric acid; adding water to production of a zirconium sulphate soln.; and adding to said soln. chloride of sodium.

Enameled ware. HAROLD F. WHITTAKER and THEODORE BAKER, U. S. 1,496,505. June 3. In the method of making chem.-resistant enameled ware having a metallic base, the step which comprises incorporating in the base material a metal capable of rendering the coeff. of expansion of the metallic base substantially the same as the coeff. of expansion of the enamel component of said ware, shaping said base mat. into the desired form, and applying thereto the enamel. As a new article of manuf. enameled ware having a metallic base and comprising an enamel having high chemical resistance and a relatively low coeff. of expansion, and a metallic base consisting of an alloy whose coeff. of expansion is substantially the same as that of the enamel. As a new article of manuf., an enameled iron alloy comprising an enamel whose components are present in the following proportions:

	Per cent
SiO_2	67.0 to 75.0
B_2O_3	4.0 to 24.0
Na_2O	4.0 to 8.5
K_2O	0.2 to 1.3
CaO	.2 to 7.0
MgO	.0 to 0.5
Al_2O_3	.0 to 10.0
PbO	.0 to 1.0

and an alloy having substantially the same coeff. of expansion as said enamel and contg. between 50 and 68% of iron and between 43 and 32% of nickel.

Glass

Use of phonolite in the glass industry. R. PFLOCK. *Sprech.*, **56**, 355–6(1923).—Only those plants operate for long periods of time who have their mats. analyzed at frequent intervals. One should not wait until the quality of the product has dropped before doing this since in this case it may be too late. A portion of the glass industry at least has taken the advice of the chemist and has been greatly benefited. This was done by the substitution of phonolite in the place of soda in the glass industry. A phonolite is mined in Germany having the following analyses:

Ignition loss	2.26	Lime, CaO	2.45
Silica, SiO_2	60.50	Potash, K_2O	5.06
Alumina, Al_2O_3	20.30	Soda, Na_2O	6.29
Iron oxide, Fe_2O_3	2.99	Magnesia, MgO	0.08

A double truck of phonolite would be equiv. to the following amts. of raw mats.:

	Kg.		Kg.
Sand	12000	Lime	870
Alumina	4000	Soda ash	3400

Over 2,000,000 marks are saved in substituting a double truck of phonolite for a mixt. contg. soda ash. In addition to this, the cost of handling would be less since not so many mats. will have to be measured and added. The moist. content is practically 0 and the compn. does not vary much over long periods of time. Phonolite melts to a glass at 1150°C which is a lower temp. than a synthetic mixt. of this compn. would melt at. Also in working no difficulty is encountered in using this in semiautomatic and an automatic machine as one might expect from its high Al_2O_3 content. Heretofore because of its high Fe content it was used exclusively for bottle and green glass. Its resist. to atmos. agents, acids and alkalies make it useful for glass brick, tubing, accumulator glass, preserving glass, for all sorts of colored glasses used for chemicals and pharmaceutical purposes, for basins, window glass, pressed glass, glass fittings, and chem. app. The use of phonolite in the glass industry has resulted in an improvement in the quality and a reduction of the costs. H. G. S.

Increase melting area—decrease repairs by insulating glass tank. ANON. *Cer. Ind.*, **2** [6], 349(1924).—Interview with W. K. Brownlee, Pres., Buckeye Clay Pot Co., Toledo, O. The insulation of a glass tank permits of lower operating furnace temp. with a given production. The outside walls of the furnace, being cooled by a strong air blast, chill the molten glass which sinks, whereas, the hotter glass in the center rises. That such convection currents do exist is confirmed from results of approx. tank wall readings made at the Bulb Plant of the Gen. Elec. Co. where a temp. differential of approx. 100°F per ft. of height in glass was noted from pyrometer readings taken simultaneously. Also very marked vertical lines of erosion are produced by the glass currents moving down the walls. A small test-tank furnace was built with flux blocks for the walls and floor and insulated throughout with $2^1/_2$ in. of Sil-O-Cel. The section of the test furnace is shown. The furnace was fed at the rate of 1500 to 1600 lbs. of batch without cullet per 24 hrs. and operated at 2500 to 2600°F for 30 days. The glass was ladeled out and the furnace allowed to cool. The insulation had equalized the internal tank temps. so as to obviate vertical currents with the consequent elimination of vertical erosion as shown in a view. The real significance of the insulation lies in the uniformity of glass temp. and lower average tank temp., rather than in any fuel saving, although this latter is quite marked. The approx. amount of heat lost through radiation in the average glass tank is 60 to 65%. Five to 6% of the heat generated is used to melt the glass. In the insulated tank, flowing action is maintained throughout the entire tank vol. This slower, though widely distributed movement, should effect a daily production equal to that of an uninsulated furnace, with its highly localized though relatively more rapid flow. The corrosive effect of the fluxes on the ports is minimized when the mass of glass progresses more slowly. The reduction of the heating temps. removes one of the most common causes of tank block disintegration. Clay tank blocks like clay pots should be burned to a higher temp. than the temp. used to melt glass, in order to eliminate subsequent shrinkage and minimize the absorption of alkali fluxes. This would mean that the dimensions of the blocks would have to be cut down in order to be fired successfully. Excessively thick blocks really constitute insulation and burn away readily to a comparatively thin section. The best construction for insulation is blocks that do not weigh over 125 lbs. and are not over 8″ thick by 12″ wide by 18″ long or even less, 8″ x 8″ x 12″. A photo of the interior of a tank shut down for repairs indicates that German tank blocks are inferior to the domestic product. P. D. H.

Surface alteration in glass detected by high voltage currents. PAUL WOOG. *Le Verre*, **4**, 54(1924).—In detg. the dielectric strength of liquid hydrocarbons the following phenomena were noted: The liquid was contd. in a thin cylindrical glass vessel 145 mm. high, 66 mm. in diam., filled to a height of 100 mm., standing on a circular

metal plate 114 mm. in diam. On top of the vessel was placed an ebonite strip holding in place through its center a brass rod 134 mm. long and 5 mm. in diam., terminating in a brass sphere 12.5 mm. in diameter. The brass rod (a 7 mm. length) and the sphere were immersed centrally in the liquid. An alternating current of 25 cycles was applied to the metal plate and the brass rod. With sufficient voltage a discharge was obtained, the current flowing from the brass rod to the surface of the glass, and over the surface to the metal plate. With a cylinder washed with dilute HCl, then with water, dried at 100°, then filled with an anhydrous mineral oil the resistance is high, but the moisture retained on the surface is sufficient to conduct the current and a discharge is obtained. With rise in temp. of the oil a corresponding lower discharge voltage was necessary, thus 11° 67.700 (volts), 20° 65,400, 40° 62,150, 60° 59,300, 80° 56,650, 100° 54,100. If, however, a hydrocarbon is used contg. a trace of water the discharge voltage decreases with the temp. on cooling the liquid, and then rises again on heating the liquid, *e. g.* (cooling) 18° 65,800 (volts), 16° 62,950, 14° 38,000, 12° 27,300 (heating), 12° 26,700, 14° 30,350, 16° 36,600, 18° 56,500, 20° 64,550. The explanation is given that the surface of the glass effloresces, liberating bases by the hydrolysis of the silicates. The carbon dioxide of the air causes the formation of a thin film of sodium carbonate. This salt crystallizes with 4 or 5 mols. of water at ordinary temp., but on cooling will form the hydrate with 10 mols. of water, if the water is available. The latter effloresces on heating when its v. p. is higher than that of the water vapor contained in the liquid. If this film is attacked by traces of free acid in the oils, the discharge voltage rises rapidly. By this method 1 part of water in 60,000 parts of oil can be detected. L. N.

Notes on the welding of glasses. Leon Appert. *Le Verre*, **4**, 25–9, 49–53 (1924).—After some historical notes A. discusses the properties which influence the welding together of glasses as in the casing of colored glasses, and the welding of glass and metal as in enamels. *Coeff. of Expansion:* Successful methods for detg. whether two glasses are sufficiently similar in their coeffs. of expansion to remain welded together without strain are given as follows: (1) A thin sphere (*a*) of glass V_1 is blown covered with an equally thin layer of glass V_2, and another sphere (*b*) is blown having V_2 covered by V_1. Let it be assumed that V_1 has the greater coeff. of expansion. If the coeffs. of expansion of these two glasses are much different in value, sphere (*a*) will usually shatter with a loud report into a number of pieces, which are smaller and more numerous as the coeffs. diverge. Sphere (*b*) will remain intact and will be found to be very resistant to repeated hard blows, cracking irregularly. In sphere (*a*) glass V_1 is under tension, while in sphere (*b*) it is under compression. When the spheres are tapped near the mouths of their openings, both will crack irregularly into a number of pieces, but sphere (*b*) will have more curved and irregular cracks. If the two glasses are alike in their coeffs. of expansion, the cracks will follow much straighter curves. (2) On the inner side of pieces of each of the two spheres scratches, fairly close together, are made with a diamond or steel cutting wheel. If the glasses are alike, the pieces can be parted along the scratches. In the present case sphere (*a*) will throw off splinters of glass at the cutting line as the scratching proceeds, while sphere (*b*) will only be scratched and cut with difficulty. Here again in sphere (*a*) glass V_1 is acting under tension, while in sphere (*b*) it is under compression. Skilled operators by these tests can differentiate between glasses varying in some of their chem. constituents by $^1/_{25}$, or by $^1/_{250}$ of the total batch wt. L. N.

Treatise on operating glass melting tanks. Bjarne Schieldrop. *Glass Worker*, **43** [31], 11; [32], 11; [33], 18; and [34], 18(1924).—Systematic ht. balance for checking operations is advocated. Daily records of gas analyses, regenerator and flue temps. will allow saving of fuel and improved quality of glass. Detail of ht. balance is given. The importance of stack losses, excess air, etc., is shown. Draught and gas velocities

should be calculated before the furnace is built. Complete data are necessary to correctly understand operation. R. J. M.

The history, development and commercial uses of fused silica ware. RICHARD A. S. PAGET. *Chem. Trade Jour. and Chem. Eng.*, **74,** 153(1924).—P. reviews the important advances made in silica ware manuf. and discusses the coeff. of expansion, devitrification, permeability, etc., of silica glass. P. W. K.

Glass-polishing by acids. OTTO W. PARKERT. *Diamant,* **46,** 187(1924).—An efficient and cheap substitute for polishing glass by stone or sand is to use an acid-bath of which the essential constituent is hydrofluoric acid. Other acids, such as sulphuric, hydrochloric, or nitric, may be added. A formula given is: 2 parts sulphuric, 1 part hydrofluoric, 1 part water. The ware is rinsed in soda solution, then washed with water, and placed in the acid-bath at 40° 60°C for thirty seconds. The process is handled with rubber gloves. H. H. S.

Clear fused quartz. E. R. BERRY. *Chem. Met. Eng.*, **30,** 715–17(1924).—Clear fused quartz, heretofore made only in small sections by hand labor in the blast flame, has now been made on a commercial scale by the Gen. Elec. Co. Water clear rock crystal contg. less than 0.2% impurities is the raw mat. The selected crystals are packed tightly in a graphite crucible, and raised rapidly to the m. p. in a modified vacuum fur. Fusion occurs within 45 min., with a power consumption of 3–8 kw.-hr. per pound of quartz. A clear, transparent slug containing a few small bubbles is obtained from this first fusion. This is placed in another graphite crucible suspended in a vertical carbon tube fur. A graphite piston with a wt. attached is placed on top of the slug which is again brought to fusion, the bubbles collapsed, and the quartz extruded in various forms. Its extremely low coeff. of expansion suggests many uses for this material. It is possible to transmit light through very great lengths of curved quartz rod with very little loss. M. E. M.

Fused silica. RICHARD PAGET. *Nature,* **113,** 748–52(1924).—A history of the development of fused silica from 1711 when tubes fused by lightning were discovered in Silesia by Hermann. In all the early processes, which are briefly described, it was essential to keep the temp. as low as possible, so as to avoid the reaction, which takes place at high temps. between silica and carbon, producing carborundum and evolving carbon monoxide. In 1903 a method was sought of fusing silica by means of elec. resist. or arc heating. It was accomplished in 1904 and from it was developed the present methods whereby fused silica is melted by means of an electrically heated carbon or graphite rod. When the fusion has been brought to the right degree of plasticity the rod is withdrawn, and the fusion is drawn, or blown by internal gas pressure, either freely or into a mold, or is pressed or rolled without reheating. The essential conditions are that the fusion shall not touch the rod, excepting at its relatively cool extremities. The most imp. property of fused silica is its low coeff. of expansion—being less than $^1/_6$ of that of the best Jena or Pyrex glasses and less than $^1/_{20}$ of the high expansion glasses. The relative expansion of rods of fused silica, glass and a metal is shown by illustrations of results of expts. at various temps. The phys. properties of fused silica are, briefly, it devitrifies less rapidly than silica mixed with any known subs.; d. of transparent fused silica is 2.21, while that of the opaque variety is 2.07; its hardness is of the same quality as hard glass; its elasticity is 6.6 kg. per mm. as against 6.0 for Jena glass; crushing strength about 7 T. per sq. in., *i. e.* between that of granite and blue brick; tensile strength of quartz fiber, provided the surface is unscratched, is 70 T. per sq. in. Its most interesting chem. property is its resistance to acids. This is shown by illus. of expts. Fused silica is unattacked by metals and metallic vapors in a non-oxidizing atmosphere; it is permeable to gases at high temps.; it has outstanding advantages as an elec. insulator, its resistivity at 150° being 500 times that of porcelain. In optical

properties it is noted for its high transparency to ultra-violet radiation, visible light, and heat. An expt. is described in which a fused silica rod 4 ft. long, and bent through 270° has one end heated to incandescence by an oxy-hydrogen blowpipe. The light passes through the length of the rod, being guided by internal reflection and emerges at the thickened opposite end as a colorless beam. The article is very instructive and well illusd. O. P. R. O.

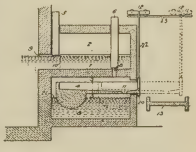
The physical properties of glasses. FRITZ ECKERT. *Jahrb. Radioakt. Elektronik,* **20,** 93–275(1923).—A bibliography contg. 383 items is given. These are classified under the following headings: collective works; optical glasses and their optical consts.; dispersion of optical glasses; absorption of colorless glasses; absorption of colored glasses; action of the absorbed energy; the relation between refraction and the compn., pressure, and temp.; reflection and elliptical polarization; electro- and magneto-optics; elec. and magnetic properties; d., and heat expansion; heat and mol. properties; elastic properties; behavior of glasses at higher temp. The relevant matter in each reference is summarized and combined in the form of a comprehensive monograph. R. H. L. (*C. A.*)

The glass industry. DELLOYE. *Génie civil,* **84,** 89(1924).—A review of recent work, especially in America. J. J. H., JR. (*C. A.*)

Sintered glass. ANON. *Nature,* **113,** 579(1924).—Filter plates of sintered glass have been placed on the market by Messrs. Scott and Co., the Jena glassmakers, according to the *Chemiker Zeitung.* It is pointed out that these have many applications in all branches of chemistry, examples in analytical, preparative and electro-chemistry being quoted. Series of filters of stopping powers are marketed. O. P. R. O.

PATENTS

Glass manufacture. ELMER DAVIS. U. S. 1,496,151, June 3. In app. for manuf. of glass, a tank having an extended end portion divided into upper and lower compartments for contg. molten glass, a closable port interposed between said compartments for the discharge of glass therethrough, a glass conveying trough normally positioned within the lower compartment having one end extended and supported by means outside of said compartment with its inner end supported by its own buoyancy in the molten glass, and positioned to receive molten glass discharged from said port.



Forming silica-glass articles. BRITISH THOMSON-HOUSTON CO., LTD. Brit. 207,457, March 16, 1923. A method of making articles of fused quartz consists in exerting a molding press. on the quartz, while it is plastic, by the expansion that takes place when the quartz passes from one modification to another modification of lower density. Suitable construction is specified. (*C. A.*)

Forming silica-glass articles. BRITISH THOMSON-HOUSTON CO., LTD. Brit. 210,707, Sept. 25, 1923. Articles from transparent quartz produced by extruding fused quartz through an orifice in a graphite container contain striae. The surface layer of the quartz is removed, before it is worked up into finished ware, by mechanical means or by treatment with hydrofluoric acid. Cf. *C. A.*, **18,** 1557. (*C. A.*)

Heavy Clay Products

Building materials from waste. A. P. LAURIE. *Nature,* **112,** 956(1923).—The large accumulations of blast furnace slag, cinders, clinkers and burnt shale in the vicinity of Edinburgh have given occasion for an investigation as to their utilization for building materials. They can be used for brick, cement, and as aggregate mixed with Port. cement or plaster of Paris. The general method adopted for the production of bricks

is known as the sand-lime process. Briefly, this process consists of mixing the aggregate with a certain proportion of lime and water, squeezing it into a brick under a pressure of some two hundred tons to the area of the brick and then steaming under high pressure or in open steaming chambers. Bricks are now being manufd. by this process from sand, blast furnace slag, granulated by being run while hot into water, clinker, town refuse, slate dust, and burnt shale from the Scottish oil shale dumps. O. P. R. O.

Refractories

Selection factors in choosing refractories for industrial plant use. O. A. HOUGEN. *Chem. Met. Eng.*, **30**, 737–41(1924).—Contains a table giving the phys. and chem. properties of 23 different refrac. mats. M. E. M.

American magnesite handicapped. ANON. *Iron Trade Rev.*, **74** [16], 1048 (1924).—Rich deposits of magnesite are on opp. side of this continent from largest consuming steel plants and cannot compete with Austrian imports. Domestic production rose with World War but declined with resumption of importation. Table on world production of crude magnesite showed Greece leading, with the U. S. second, for 1921 (Austria not included). Table of consumption in the United States shows 58% of total imported in 1921 as against 11% in 1917. T. D. H.

Best results secured by using fire brick of uniform thickness. M. S. GEREND. *Power*, **59** [21], 831(1924).—The advantages to be obtained by the use of fire brick of uniform dimensions are outlined. Drawings are given illustrating two types of calipers for use in sorting out brick of any specified dimension. C. J. H.

Properties required of refractories for heat treating furnaces. E. B. PRENTICE. *Fuels and Furnaces*, **2** [3], 283(1924).—It is impossible to secure a refractory embodying all of the characteristics reqd. in ht. treating furs., in a single material. The consumer should, therefore, carefully diagnose conditions with respect to temps., spalling, abrasion from charging ware, fluxing from metal scale or fumes from the use of case-hardening mats., etc., and then furnish the manufacturer a complete analysis of conditions in order that special mixts. may be made when necessary. Diffs. in requirements of hearths and piers are pointed out as examples. A refractory with sufficiently high fusion point to guarantee efficient results and allowing for an adequate "factor of safety," rather than one that just "gets by," should be chosen. Spalling can be largely prevented by using a refractory coating which raises the fusion point of the surface above the encountered temps. Fusion can be largely prevented by the application of a neutral coating or selecting a refractory high in alumina content and correspondingly low in silica. R. D. L.

Whiteware

New $1,000,000 pottery contains wealth of modern plant equipment. ANON. *Cer. Ind.*, **2** [6], 359(1924).—Interview with A. V. Bleininger of the Homer Laughlin China Company, Newell, W. Va. The plant was designed after the inspection of a number of potteries in order that all new ideas of modern plant equipment might be considered. The bldg. is 800 ft. in length and 290 ft. in width. The plant is so arranged that the ware moves in one direction from the raw material bins to the packing room. The bldg. is of monitor type construction which gives excellent lighting conditions. The raw materials are unloaded from the cars to the bins by means of a clay unloader. A combined scale and batch car which travels on a narrow gage track is used to transfer the raw materials from the storage bins to the five blungers. The blungers are lined with vitrified paving brick which are placed in staggered formation in order to minimize the blunging time. The batches are blunged 40 mins. The slip passes from the blungers through a coarse screen and is then pumped into two rough brick-lined agitators above

the floor. The slip flows from the rough agitators over a rotary screen covered with IIXX silk lawn, flows by the magnetic separator, and into the storage agitator from which it is pumped to the five filter presses. These 72-leaf presses are refilled five times each day. The cakes are pugged in a horizontal pug mill, cut into 3-ft. lengths, of about 75 lbs. each, loaded into carts and elevated to the working floor where they are distributed to 17 jiggermen. Approximately 1000 of the clay cylinders are required for one day's production. The clay body is not aged. A prepared clay storage is provided in a damp cellar from emergency only. The jiggers have individual motor drives. There are ten revolving stove rooms, heated with hot air to 120°F, which are used for the smaller ware. There are seven especially designed chain driers which have a capacity of 125 doz. 7″ plate molds. The close regulation of the temperature eliminates the loss due to burned molds. Three men are used at each bench. Three stove rooms are provided for drying cups to the leather-hard stage. The cup lathes are driven by individual motors. The cast handle department is adjacent to the lathes. The casting slip is prepared in a separate blunger with the addition of .2% of a mixture of sodium silicate and soda ash in equal parts. The slip is supplied to the molds through flexible hose. The grog for the saggers is ground in a dry pan and screened. The material passing a 4-mesh and retained on a 16-mesh screen is used. The sagger body is prepared by soaking layers of grog and clay in pits and then pugging the mixture twice, at least 24 hrs. being permitted to elapse between the pugging in order to insure a uniform moisture content. The prepared body is elevated to the main floor by means of a belt elevator. The saggers are made by hand and on a sagger press. The daily hand production per man is 100 saggers, whereas the press production is 320 saggers. The saggers are dried in a hot air tunnel drier on steel pallets supported on suspended cars. It is expected, however, to utilize the waste heat from the tunnel kilns in the sagger drier. The overhead track makes a loop by the bisque kiln and back to the sagger room. The car platforms of the bisque kiln are at shop floor level which facilitates loading. The loaded cars before entering the kiln must pass through a pilot gate identical with a cross section of the kiln interior. The bisque kiln is 331 ft. in length and holds 53 cars. The kiln is operated on a schedule of 80 mins. per car. The car setting is 6 ft. in length by 5 ft. in width by 5′ 4″ in height. This allows extra saggers to be placed one high in the middle of the car. The capacity of the cars is 103 jack saggers. There are five furnaces on a side burning natural gas and equipped for oil as a substitute. The pyrometric equipment consists of one three-point recording potentiometer, one twenty-point indicating instrument, an optical pyrometer and pyrometric cones. The bisque is fired at cone 9. The bisque ware is unloaded on a belt conveyor from which it is sorted and placed in movable bins. The bisque is cleaned between revolving brushes. The glaze frit kiln has a daily capacity of 8 charges of 825 lbs. each. The frit is ground for 30 hrs. in 5 flintstone lined ball mills. After the glaze has been ground it is sieved through a rotary silk lawn, passed over a magnetic separator and into agitators from which it is pumped to the dipping line. The dipping is done from fixed tubs in front of 6 upright mangles each containing 51 shelves. The glost kiln is 301 ft. in length with the same cross section as the bisque kiln. There are four furnaces on each side. The kiln is operated on a schedule of 40 mins. per car. Kiln atmospheric conditions are checked by means of the Orsat app. The same pyrometric equipment is used on the glost kiln as on the bisque kiln. The glost ware is fired to from cone 3 to $3^1/_2$. It is handled like the bisque as it leaves the kiln. The decorated ware is fired in a tunnel decorating kiln on a 15-min. schedule to a temp. of about 1400°F. The kiln has a daily capacity of 3000 dozens of ware. For this production less than 300 gallons of oil or 24,000 cu. ft. of natural gas are required. The plant has a daily production of over 5000 dozens of semi-vitreous dinner ware. P. D. H.

Porcelain as an insulator in electrical engineering. G. BENISCHKE. *Keram. Rundschau,* **32,** 215–6(1924). H. G. S.

Study of the manufacture of electrical porcelain. E. E. URBAN. *Keram. Rundschau,* **32,** 217–9(1924). H. G. S.

The development of insulators including questions on the construction of the same. W. WEICKER. *Keram. Rundschau,* **32,** 219–21(1924). H. G. S.

The use of porcelain in the construction of high tension insulators. C. H. BAY. *Keram. Rundschau,* **32,** 221(1924). H. G. S.

The testing of high tension insulators. BREDOW. *Keram. Rundschau,* **32,** 222–5(1924). H. G. S.

Regarding the mechanical properties of porcelain. E. GEROLD. *Keram. Rundschau,* **32,** 225–6(1924). H. G. S.

Cements for insulators. H. LUFTSCHITZ. *Keram. Rundschau,* **32,** 226–7(1924). H. G. S.

Stoneware as an insulating material in electrical engineering. E. E. URBAN. *Keram. Rundschau,* **32,** 229–30(1924). H. G. S.

Heat economy in the manufacture of electrical porcelain. F. GRAAFEN. *Keram. Rundschau,* **32,** 230–1(1924). H. G. S.

The insulator question in the modern wireless broadcasting station. B. FREUND. *Keram. Rundschau,* **32,** 232–3(1924). H. G. S.

The lifetime of porcelain insulators. W. CORDES. *Keram. Rundschau,* **32,** 234–6(1924). H. G. S.

The development of the German electrical porcelain industry. W. HUTH. *Keram. Rundschau,* **32,** 236–7(1924). H. G. S.

The million volt test for porcelain insulators at the porcelain factory in Freiberg, Saxony. O. NAUMANN. *Elektrotechn. Z.,* **45,** 177–80(1924); 12 illus.—A detailed account of the installation. C. G. F. (*C. A.*)

Improvements in porcelain insulators. E. ROSENTHAL. *Elec. World,* **83,** 575–6 (1924). C. G. F. (*C. A.*)

Equipment and Apparatus

Repair of leaky calorimetric resistance thermometers. J. D. DAVIS AND H. M. COOPER. *Ind. Eng. Chem.,* **16** [6], 579(1924).—The writers describe and illustrate the construction of calorimetric resistance thermometers, pointing out the advantages of use and difficulty in usual method of repair. They have found a rapid and easy method to repair this type of thermometer when moisture has been introduced into the case. The thermometer case is opened by cutting the solder joint at the lower end of the case and the glass drying capsule is removed, thus leaving the case open at both ends. A test tube large enough to contain the thermometer tube and glass outlet is filled with paraffin at about 130°C and the thermometer tube is immersed in the hot paraffin, the temp. being maintained for about 30 min., or until bubbles of air and steam are no longer evolved. After this, the tube still containing the thermometer is allowed to cool and finally broken away from the solidified paraffin. This is carefully chipped away from the thermometer, the tip is resoldered and the head sealed again with De-Khotinsky wax and the thermometer is ready for use. The drying tube may, of course, be eliminated. Thermometers that have developed leaks and have been sealed in the above manner have shown no change in the ice point, proving that the original characteristics have not been altered. The lag for one degree temp. change is not appreciably changed, this being about 5 sec. R. D. L.

Design and operation of a colloid mill. W. A. MCLEAN. *Chem. Met. Eng.,* **30,** 675–7(1924).—Describes a mill invented by F. J. E. China, of London, and used com-

mercially for a year. The mill will disintegrate solid, plastic, or liquid masses into colloidal particles whose dimensions are one micron or less in diam. In design the mill consists of a rotor with a smooth face upon the frustrum of a cone, turning within the similar surface of a stator, the whole enclosed in a casing. Thus there are two variables in operating the mill; the clearance between rotor and stator, which may be from 0.002 in. up, and the speed of rotation, which may vary from 1000 to 20000 r. p. m. Solids must first be ground to about 150-mesh and suspended in a liquid medium. The centrifugal action of the rotor sucks the liquid through the inlet at the bottom of the mill, through the space between rotor and stator, and out through a discharge above the rotor. From 1 to 2.5 tons of feldspar per hour may be ground to colloidal fineness, with the passage of 3.5 to 5 T. of water medium. A discussion of the disruptive forces used by the mill is given, together with figures on power consumption. M. E. M.

Continuous grinding in the ceramic industry. ANON. *Chem. Met. Eng.*, **30,** 783–4(1924).—A description of the new plant of the Amer. Grinding Co. Feldspar, silica and clay are ground by a continuous process, to —200 mesh. The raw mat. is ground wet in a Hardinge mill, passes through 2 Dorr classifiers and a Dorr thickener, is dewatered on a vacuum filter and delivered to a tunnel drier. M. E. M.

Industrial kinetic elutriation. L. ANDREWS. *Chem. Trade Jour. and Chem. Eng.*, **74,** 403(1924).—A. describes an elaborate "kinetic" fractionating elutriator. The water suspension is forced, at high velocity, tangentially into a stationary annular chamber. The centrifugal force on the suspended particles in this rapidly rotating liquid gives the initial sepn. The fractions are further purified 2 or 3 times by ordinary gravitational elutriation. P. W. K.

The determination of the viscosity of highly viscous substances. E. BERL, M. ISLER AND A. LANGE. *Z. angew. Chem.*, **37,** 128–31(1924).—A simple app. is described for the accurate detn. of the viscosity of highly viscous materials. It consists in measuring the time required to withdraw a plunger immersed in the material a short distance under the influence of the force exerted by a known weight. The plunger is suspended from the left-hand side of a balance arm so that it dips a given distance into the viscous material. Weights are added to the right-hand balance pan until the balance is in equil. in this position. A certain addl. weight is then added and note made of the time required for the balance pointer to swing from the equil. position over a given no. of scale divisions. F. L. B. (*C. A.*)

Kilns, Furnaces, Fuels and Combustion

Automatic control of a tunnel kiln. I. P. DRESSLER. *Fuels and Furnaces*, **2** [1, 2, 3], 33, 125, 249(1924).—This is a series of articles describing the opern. of a Dressler car-tunnel kiln burning spark plug porcelain at the plant of the Champion Porcelain Company, Detroit, Mich. The 1st article deals largely with a general description of the construction of a Dressler car-tunnel kiln and is accompanied by photographs illustrating the subject matter. Mention is made of the ht.-resisting qualities of present-day porcelain ware for spark plugs and the necessity for accurate burning control, both as to temps. and atmospheres in the kiln. Method of controlling the gas pressures by installation of a sensitive regulator in the main line is given. Since the gas supply was made up of coke-oven, retort and carburetted water gases, which are pumped in either singly or mixed, some device had to be developed for overcoming wide variations in B.t.u. content of the gas supply and also varying densities when attempting to maintain the proper reducing, neutral or oxidizing atmospheres at the proper points in the kiln. The 2nd article deals with the description of the app. devised and successfully used for this purpose and is also accompanied by drawings and photographs. The 3rd and last article describes the mechanism developed for controlling the auxiliary burners which determine the kiln atmospheres. Electrical CO and CO_2 meters now

available have been found inadequate, because as successive bungs of saggers come opposite the gas sampling points, due to the movement of the cars, a very distinct variation in the gas passing into the recorders takes place and this has the effect of throwing out any adjustment depending on the reading. The articles offer a very interesting and informative description of the methods utilized in controlling burning where the utmost efficiency must be combined with absolute uniformity of a product possessing exacting requirements which is produced under definitely known conditions. R. D. L.

Geology

Steatite. ANON. *Keram. Rundschau,* **32,** 233–4(1924). H. G. S.

The gypsum deposits of southwestern Persia. J. V. HARRISON. *Econ. Geol.,* **19,** 259–74(1924).—The paper records field observations on the occurrence of gypsum in southwestern Persia, with special ref. to the light they throw upon the origin of the deposits of this mineral. Proof is available that it has been produced in part by chem. replacements of limestone. Porous variable limestones of Persia are regarded as deposited from soln. subsequent to the gypsum in which they occur. The gypsum occurring with the Eocene limestone is regarded as due entirely to the metamorphic action of sulphur-bearing soln. from the mudstones upon the limestones. Some of the Fars gypsum owes its origin to a similar chem. action on the limestones of that formation and some to deposition from evapg. soln. The metasomatic gypsum has been forming since Pliocene times and continues to form at the present day. C. W. O.

Bauxite and laterite occurrences (India). ANON. *India Geol. Surv. Memoirs,* **49** [1], 287.—A well-balanced survey of the known facts regarding the bauxites and laterites of the world. Mr. Fox discusses in his 1st chapter the mode of occurrence, physical characters, mineral constitution, chem. compn., origin, age and economic uses of bauxitic laterites. His 2nd chapter is a detailed description of the occurrences in India, and the third chapter is a summary of the facts known regarding the bauxites and laterites of extra-Indian countries. The final chapter gives a summary of the chief points of each paper of importance previously published on the subject. In dealing with the constitution and origin of bauxite, F. has made a definite advance upon the previously recorded ideas, for he has applied the newly developed science of colloid chemistry to the constitution of bauxite, and has directed attention to the remarkable way in which the lateritic hill-caps in Peninsular India fringe, as well as lie on, the Deccan trap area and probably represent the decomposition product of the trap and its outliers.

O. P. R. O.

Chemistry and Physics

New method of making the Koerner rational analyses of clays. G. KEPPLER AND H. IPPACH. *Sprechsaal,* **56,** 356–7(1923).—The Koerner method of conducting rational analyses (*Sprechsaal,* p. 775 (1903)) is exact, rapid and economical in chemicals. In this method the colloidal silica remaining undissolved is removed with a 0.5% HF soln. This requires the use of a 250–300 cc. platinum dish which is too costly. K. and I. modified this method so that the cheaper hard rubber casseroles may be used instead. There is a big difference in the ht. condy. of the hard rubber and platinum casseroles. A platinum casserole with a certain amt. of water at 17°C when placed upon a water bath reaches 80°C in 2 mins. and 91°C in 5 mins. while a hard rubber casserole with the same amount of water reaches 28°C after 5 mins. and only 60°C after 30 mins. In the new method allowance is made for this difference in ht. condy. of the types of materials. 0.5 gr. of pulverized clay is placed in a casserole and 75–100 cc. of H_2O are added. The clay is thoroughly stirred until no lumps are present. After adding 10 cc. concd. H_2SO_4 the mixt. is covered with a watch-glass and allowed to

stand a number of hrs. in air and then is strongly heated over an asbestos gage after which the H_2SO_4 is volatilized. The residue is treated with H_2O on a water-bath during which treatment the bases go into soln. The SiO_2 and the feldspar remain as the residue. After filtering through a double filter the residue is thoroughly washed with a 0.5% HCl soln. The residue from the filter is transferred to a hard rubber casserole (20 cm. in diam. with a wall 3 mm. thick) and 200 cc. of boiling H_2O together with 2.5 grs. 40% HF, stirring with a hard gum rod. After stirring for 2 mins. the HF is neutralized by adding NaOH drop by drop. The quartz and feldspar are then removed by double filtration. The residue is washed first with H_2O, then with HCl and then again with H_2O. By volatilizing the SiO_2 and detg. the alkalies the feldspar content can be detd.

H. G. S.

Permeability of building materials to gases. Engineering Committee of the British Food Investigation Board. *Chem. Trade Jour. and Chem. Eng.*, **74**, 122 (1924).—The permeability of bricks, plasters, concrete, and other building mat. was measured, using air, coal gas, and CO_2. Great differences were found even in the same mat. The vol. of gas flowing through a wall in unit time was found to be propl. to the area and pressure difference and inversely propl. to the thickness. Various coatings and paints were also tested for their effectiveness in reducing the permeability.

P. W. K.

Colloid chemistry. E. K. Rideal. *Chem. Trade Jour. and Chem. Eng.*, **74**, 127(1924).—A gen. survey of the chemistry of solids dispersed in gases or liquids is given, including a discussion of the electric endosmose of clay. P. W. K.

The modern concept of solid solutions. Z. Jeffries and R. S. Archer. *Chem. Met. Eng.*, **29**, 923–6, 966–9(1923).—The authors have compiled the accepted theories of solid solns., and give a brief discussion of their formation and properties. The question is handled entirely from the metallurgical standpoint. M. E. M.

Investigation of the thermal dissociation of the hydrated aluminosilicates, prehnite, zoisite and epidote. E. Norin. *China J. Science & Arts*, **1**, 390–403(1923).—These minerals when exposed to heat dissociated into compds. sol. in HCl. The progress of the dissociation was detd. by 20 mins. extn. with 7% HCl. The amt. of SiO_2 liberated was detd. by 20 mins. extn. with 5% soda soln. Dehydration curves are drawn. The dehydration temps. detd. are: prehnite 725–50°, zoisite 900–70°, epidote 900–1000°. The H_2O in prehnite is shown to be constitutional. W. H. A. (*C. A.*)

Aluminium-titanium alloys and the influence of titanium on aluminium. E. van Erckelens. *Metall u. Erz* **20**, 206–10(1923).—Al-Ti alloys contg. up to 30.7% Ti corresponding to the compd. Al_4Ti have been investigated. This compd. forms neither eutectic nor solid soln. with Al, the solidus in the series being a straight line at 657°, the m. p. of Al. The liquidus rises very sharply, with increase in the Ti content, in a smooth curve to a max. at 1325° and 30.7% Ti. The alloy with only 2% Ti commences to solidify at about 1000° with the sepn. of Al_4Ti, followed by freezing of pure Al. The microstructure of the alloys shows needles of very hard Al_4Ti embedded in a soft ground-mass of pure Al. The effect of Ti on the tensile properties of Al is to increase the ultimate strength up to about 1%, then rapidly to reduce it. The hardness, sp. elec. resistance, and resistance to corrosion are all increased with increase in the Ti content. The chief value of Ti in Al alloys would appear to be in its great affinity for N and O; by the removal of these impurities the phys. properties of the metal are greatly improved. (*C. A.*)

Plasticity. I. Otto Ruff. *Z. anorg. allgem. Chem.*, **133**, 187–92(1924).—Plastics may contain one or several components. Fine grinding undoubtedly helps develop plasticity, but the most important factor is the development of an active surface on the particles by means of a sol-forming agent. Acids are most effective with basic oxides

and bases with acidic oxides. A certain concn. of H or OH ion is most effective as a sol-forming agent. Cf. Podszus, *C. A.*, **11**, 3406. **II. Plastic materials from zirconium dioxide.** Otto Ruff and Josef Moczala. *Ibid.*, 193–219, 416.—ZnO_2 is very slightly plastic and ware made from it has walls which are too thick; hence the effort was made to secure greater plasticity. The oxide, 99.65% pure, was heated to 1450° and ground while wet to 0.5 μ. When treated with acids or with salts which give an acid reaction a surprising amt. of plasticity was obtained. After using HNO_3, the liquid was sepd. by ultrafiltration and it was found that 0.185 milliequivalents of acid had been adsorbed. Nearly the same value was found with other acids. The adsorption is directly proportional to the time of grinding. The plasticity was judged by the behavior of the slip in the molding. It was found that the plasticity of the oxide can be destroyed by washing free of acid and that the plasticity also disappears on standing, but in either case it can be restored by the addn. of acid to activate again the surface of the particles. The theory of the active surface is based upon the formation of a basic salt which unites with acid and ionizes to form the micellion. Measurements of the shrinkage and porosity of the excellent ware made from ZrO_2 are given. The porosity may be reduced by addns. of clay, ThO_2, etc. **III. Plastic materials from aluminium oxide.** Otto Ruff and Wilhelm Goebel. *Ibid.*, 220–9.—Plastic material may be prepd. from Al_2O_3 just as from ZrO_2 and it can be used in prepg. ware for resisting high temps. The materials must be highly dispersed, and the surfaces of the particles must be activated by means of acids. The materials burn without difficulty, giving a clear ring when burned at 1500° or above. Imperviousness is to be secured by using higher burning temps. or foreign oxides such as ZrO_2. E. C. B. (*C. A.*)

The colloidal nature of clay. A. Fodor and B. Schoenfeld. *Kolloidchem. Beihefte*, **19**, 1–46(1924).—The clay was ground, sifted, made into a paste with water, acidified with HNO_3, and allowed to settle. It was then washed by decantation until the supernatant liquid remained turbid. Samples of the soil were shaken up in glass cylinders with water and solns. of electrolytes and the rate of sedimentation observed. NH_4OH in small amts. favors suspension of the clay. In larger amts. it causes aggregation of the particles but not coagulation. Cataphoresis expts. show that even in these high concns. the NH_4OH increases the charge on the particles. NaOH in small amts. favors suspension, slightly higher concn. ppts. the larger particles but not the smaller ones, while still higher concns. ppt. completely. As with NH_4OH, the Brownian movement ceases in solns. contg. much less NaOH than is required to cause coagulation or to remove the charge on the particles. The phenomenon of "reliquefaction" of clay whereby an amt. of NaOH sufficient completely to coagulate a suspension on standing becomes insufficient to prevent its suspension again, is explained on the basis of peptization of the clay by the alkali with resulting increase in sp. surface and therefore in concn. of NaOH required for coagulation. The amt. of NaOH required to coagulate a given suspension depends both on the pH and on the concn. of clay. $Ca(OH)_2$ coagulates clay suspensions in relatively low concn. The absorption isotherm was found to hold for the adsorption of both NaOH and $Ca(OH)_2$. On washing out the $Ca(OH)_2$ from the coagulated clay it did not regain its original adsorptive power for $Ca(OH)_2$. The coagula produced by alkalies appear swollen while those produced by acids have a "conglomerate" consistency. Small concns. of salts favor suspension; larger ones cause coagulation. If the optimum amt. of alkali for suspension is present, however, salts coagulate more slowly. The phenomenon of protective action is exhibited by humic acids as well as by phosphates. The protective action of phosphates is not a matter of pH. The phosphates are adsorbed by the clay in small amts. F. L. B. (*C. A.*)

Some new standard melting points at high temperatures. H. S. Roberts. *Phys. Rev.*, **23**, 386–95(1924).—M. ps. of common inorg. salts, detd. by a crucible method,

using calibrated thermels, are suitable for the calibration of thermels. The flatness of the heating curve is a sensitive test for purity. Detailed suggestions as to technic are given, also a convenient method of using pure metal strips or wires in calibration. Results are as follows: $K_2Cr_2O_7$, 397.5° ± 0.5°; (30.5 NaCl + 69.5 Na_2SO_4), 627.0° ± 0.5°; KCl, 770.3° ± 0.5°; NaCl, 800.4° ± 0.5°; Na_2SO_4, 884.7° ± 0.5°; K_2SO_4, inversion 583° ± 1°; m. p. 1069.1° ± 0.5°; $Ca_2B_2O_5$, 1304° ± 5°. B. H. C. (*C. A.*)

Physico-chemical phenomena in glass making and ceramics. ALBERT GRANGER. *Chaleur et industrie*, **5**, 34–7(1924).—An address. A. P.-C. (*C. A.*)

Influence of certain fluxes on the softening temperature and fluidity of a monosilicate mixture of lime and silica. W. S. PATTERSON AND P. F. SUMMERS. *Bull. Inst. Mining Met.*, No. **233**(1924).—The fuel consumption of a furnace may well be governed by the temp.-viscosity relations of the slags formed. ZnO, MgO and Al_2O_3 require the most superheating and in practice would require a considerable fuel expenditure to render them sufficiently fluid to flow from the furnace. With high percentages of Al_2O_3 the slags are particularly viscous. Although FeO and Fe_2O_3 yield slags which are extremely fluid, their presence in large amts. may raise the sp. gr. to an undesirable extent, and prohibit a satisfactory sepn. of metal from slag. When $2CaO.SiO_2$ is cooled down, the transition from the β- to the γ-form occurs at 675° and is accompanied by a vol. change of nearly 10%, resulting normally in the disintegration of the silicate. During the measurements of the softening temp. of the silicate mixts., this tendency to powder was particularly noticeable with some bases, with others it was suppressed. When 25% of the CaO had been replaced with FeO, Fe_2O_3, SnO_2, MgO, or Al_2O_3, none of the cones disintegrated on cooling, these bases being very active in suppressing the change. ZnO and PbO did not suppress the β- into γ-change up to 75% CaO replacement; but above this amt. none of the cones fell to powder on cooling.

E. F. P. (*C. A.*)

General

In Russia there has been organized a fourth service arm, the "Dobrokhim," or "chemical volunteers." *London Times*, May 22. H. H. S.

Foundry school established in France. VINCENT DELPORT. *Iron Trade Review*, **74** [15], 992(1924).—The first school established in France for training engineers specially for foundry management was opened in Paris, Jan. 7, 1924. A limited number of students from foundries and engineering schools are chosen by competitive examination for one year course in foundry practise, previous training in math., phys., chem. and drawing being required. T. D. H.

Sawdust as a fuel for gas production. HARROLD DORMAND. *Power*, **59** [22], 862(1924).—The production of gas from sawdust is described; pictures of the gas producer are shown. The disposition of sawdust in some industries presents a difficulty. The burning of sawdust under boilers has not been carried out entirely successfully. The present installation makes gas to run a gas engine at a lumber mill. Apparently gas from sawdust for power purposes is entirely possible with the correct type of producer. C. J. H.

How relative drying time may be approximated. E. B. ATWATER AND R. A. BORLSLAND. *Chem. Met. Eng.*, **29**, 226–30(1923).—Drying tests were made on various mats., using a steam-heated pan drier. Samples from the charge were analyzed for moisture at regular intervals until the mat. approached zero moisture. Curves, in which per cent moisture is plotted against time, are given for coal, sawdust, gypsum, fire clay and sand. While the absolute time shown on these curves applies only to the drier used, the relative time required for drying any mat., between two moisture limits, applies to any drier. M. E. M.

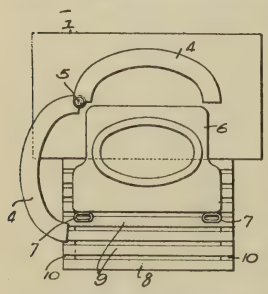
Stoneware clays. ALIX CORNILLE. *Rev. Mat. Constr. Trav. Pub.*, **175**, 75–6B (1924).—The following are some French clays which when used alone give good quality stoneware. They are also noted for their wide heat range.

	Dion (Allier)	St. amant en Puisaye (Nievre)	Ramberviliers Crude	(Vosges) Washed
Water and Ignition loss	7.65	10.86	7.98	7.66
SiO_2	62.32	64.17	65.94	48.63
Al_2O_3	25.74	20.56	20.13	30.71
Fe_2O_3	1.90	1.01	1.76	3.67
TiO_2	tr.	0.82	tr.	tr.
CaO	0.17	0.23	0.44	0.26
MgO	0.37	tr.	0.77	2.24
Alkalies	2.05	2.20	3.37	6.70
Fusion Range, Cone	9	6–8	4–5	less than 4

L. N.

Silicate of soda for treatment of concrete roads. ANON. *Nature*, **112**, 953(1923).—Silicate of soda is being more and more used for surface treatment of concrete. Chem. reactions that result from the application of a dilute soln. of silicate of soda to concrete, are very complicated, but seem to include the combination of the silicate with free hydrated lime liberated in the setting of cement to give a lime silicate, which forms a hard compd.: the net result is the formation of an intensely hard outer skin—in which all the pores have been completely filled up—strongly resistant to abrasion and dusting, and largely waterproof. It is essential that the silicate of soda be sprayed over the road in the form of a very dilute soln., *viz.*, 1 of the liquid neutral silicate to 4 of water, while the silicate of soda must be prepd. for the specific purpose, with a fairly high ratio of silicate of soda. As is well known, very many grades are supplied, from a low-ratio product containing 1.60 molecules silica to 1.00 mol. soda (Na_2O) to a very high-ratio grade with over 4.00 mols. silica. The right brand to use is a matter of experience and research, but the results, under proper conditions, are remarkable, and constitute a factor of national importance in the upkeep of roads.

English China Clays, Ltd. ANON. *Oil & Color Trade Jour.*, **65**, 1355(1924).—Eng. China Clays, Ltd., report for 1923 states that the vol. of business was greater, both in home and export markets, than in the preceding year, but the demand for china clay in the world's markets is still below pre-war levels. Until Russia and Central Europe again become effective customers the capacity of china clay companies will continue largely in excess of the world's demands. O. P. R. O.



PATENTS

Apparatus for and process of making saggers. EUGENE A. HULTS AND JOSEPH F. MORANZ. U. S. 1,496,642, June 3. The combination in means for forming saggers and other bodies of green clay, of a molding press; a removable plate on which a sagger is formed; a slatted tray on which the plate, with the sagger, is placed; a stop partly encircling the sagger, said stop having pins engaging the tray so that the plate can be withdrawn to allow the sagger to rest directly on the tray.

Smoke abatement. E. MUMFORD, F. MUMFORD and W. H. MUMFORD. Brit. 210,581, Dec. 8, 1922. A soln. of 1 lb. $CaCl_2$ in 5 gals. H_2O is sprayed over the fuel on a furnace grate to minimize the evolution of smoke. $NaNO_3$ or KNO_3 may also be added to the soln. (*C. A.*)

BOOK REVIEWS

The Silica Refractories of Pennsylvania. E. S. Moore and F. G. Taylor. Pennsylvania Topographic and Geologic Survey, *Bull.* **M3,** 100 pp., 1924.

A comprehensive report on the silica refractories industry of Pennsylvania. The report includes chapters on the mica-schist quarries of eastern Pennsylvania; the geological formation, character and extent of the various deposits of quartzite; quarrying methods; descriptions of properties and plants of companies quarrying quartzite or making silica brick; the manufacture of silica brick; and chemical and phsyical properties of the silica minerals and of silica brick.

In 1920 Pennsylvania produced 73% of the quantity and 71% of the total value of silica brick manufactured in the United States. All of Pennsylvania's production, except that from two plants, comes from the formation known as the Tuscarora or Medina quartzite. The two exceptions use the Chickies quartzite (upper Cambrian age) in southeastern Pennsylvania. Certain portions of this formation are mica-schist instead of quartzite. Certain grades of mica-schist are split into slabs and used for refractory purposes.

The Tuscarora formation is Silurian in age and nonfossiliferous except for a peculiar fossil *Arthrophycus allegheniensis.* This formation is the greatest mountain-forming rock in central and south-central Pennsylvania and extends from near Williamsport on the northeast to across the Maryland line near Cumberland. A characteristic feature of the formation is the great areas of white broken rock or talus known as ganister floes, varying in thickness from 1 to 35 feet. The most striking floes are near Hollidaysburg, Point View, Water Street, Mt. Union and in Lewistown Narrows. The large floes are much in demand for the manufacture of silica brick. Sixty-five samples of Tuscarora quartzite throughout the state were analyzed, fusion point determined, and results tabulated. The most favorable areas are in Center, Blair, Bedford, Huntingdon, Mifflin, and Juniata counties. In the southern part of the state much of the rock is too soft and crumbles readily.

Companies which quarry quartzite and make silica brick are: Harbison-Walker Refractories Company, Superior Silica Brick Company, Federal Refractories Company, General Refractories Company, United States Refractories Company, Haws Refractories Company, Van Dyke Silica Brick Company, and E. J. Lavino Refractories Company.

J. Spotts McDowell

Effect of Storage of Cement. Duff A. Abrams. Structural Materials Research Laboratory, Lewis Institute, Chicago. *Bull.* **6** (1924).

Tests were made in order to determine the concrete and mortar-making properties of 3 different lots of Portland cement which had been stored up to 5 yrs. in sacks under different conditions. The cements were purchased from dealers' warehouses and stored in the Testing Laboratory, in the basement of Lewis Institute, and in a shed in the yard for 2 yrs. After 2 yrs. all cements were stored in the Laboratory. In general the cement was stored in lots of 800 to 1200 lbs. in standard cotton sacks; in one group of tests 2 brands of paper sacks were also used; in another group the cloth sacks were covered with thin layers of hydrated lime and Portland cement. Upon receipt of the cement, and after storage for 3 mos., 6 mos., 1, 2 and 5 yrs., concrete and mortar specimens were made for test at ages of 7 and 28 days, 6 mos., and 1 and 2 yrs.

This investigation included compression tests of about 1250 6- by 12-in. concrete cylinders, 1300 2- by 4-in. cylinders of 1:3 standard-sand mortar, and about 500 miscellaneous tests.

The following are the principal conclusions:

(1) There was an appreciable loss in strength of Portland cement due to storage in small lots in sacks for all conditions covered by these tests; the loss was greatest for

the cements stored in the shed, and least for those stored in the laboratory. Basement storage was almost as severe as outdoors. The loss in strength was greater for the first 3 mos. of storage than for later 3-mos. periods. In general the concrete strengths for the cements stored in the shed 1 yr. and longer were about 80% of those for cement stored in the laboratory. The deterioration shown by these tests was probably greater than would be found in a larger lot of cement stored in sacks under similar conditions. (2) The effect of storage of cement was found to be largely a question of the age at which concrete or mortar tests were made. The early tests showed a much greater loss in strength due to storage of cement than tests at later ages. It is of the utmost importance that the strength of the cement was not permanently reduced as shown by the early tests; cements stored in shed for 3 mos. gave an average "strength-ratio" of 73% (as compared to the original strength of concrete) when tested at 7 days, 75% at 28 days, and 84% when tested at 6 mos. to 2 yrs. Similar relations were found for the other conditions of storage. (3) After storage of cement in shed for 3 mos. the average strength-ratio for the ages at which tests were made was 80%; after storage for 6 mos., 75%; 1 yr., 60%; 2 yrs., 46%; and $4^1/_2$ yrs., 45%. (4) Two brands of paper cement sacks gave results which did not differ materially from cloth sacks when used for storing cement for periods up to $4^1/_2$ yrs. (5) A thin covering of Portland cement or hydrated lime over cement in cloth sacks showed some advantage, but not sufficient to justify the cost of this method of storage. (6) It appears that the deterioration of cement in storage is due to absorption of atmospheric moisture, which causes a partial hydration which, in turn, exhibits itself in the lower strength-ratios for concrete, particularly at the early ages. D. A. A.

New Book on Practical Pyrometry. Believing that enough thermo-electric pyrometers are in use to warrant a special publication on their installation and care, The Brown Instrument Company, of Philadelphia, has recently published a 72-page book covering this subject thoroughly. It is entitled "Instructions for Installation and Care of Thermo-Electric Pyrometers." There is hardly a man who works with pyrometers who does not at sometime desire information regarding protecting tubes for thermocouples, and various methods of wiring indicators and recorders, methods of eliminating cold junction errors, methods of installing couples, and of checking thermocouples, wiring, or the accuracy of the instruments. These subjects are gone into from the practical and theoretical angles, as well as such other subjects as open, and conduit wiring, mounting the instruments, locating defects in the thermo-electric circuit by various means, and many other points which will be of immense interest to the man who has to work with the equipment from day to day. This book also contains temperature Millivolt Equivalents for thermocouples and conversion of Fahrenheit and Centigrade Scales. It is free to users of pyrometers.

LIESEGANG, RAPHAEL ED.: **Kolloide in der Technik.** Dresden und Leipzig: Theodor Steinkopf. 157 pp. 3.50 M. Chapter XII deals with Colloids in Ceramics. H. H. S.

MULLER, ERICH: **Die elektrometrische Massanalyse.** Dresden und Leipzig: Theodor Steinkopf. (1923) 159 pp. 4.50 M. (The end-point of a titration is observed by change of potential of the solution.) H. H. S.

GIBBS, W. E.: **Clouds and Smokes: The properties of disperse systems in gases and their practical applications.** London: J. & A. Churchill, 1924. xiii, 240 pp. 10 s. 6 d. H. H. S.

Testing (*New Journal*). CHARLES O. REID, Editor. Vol. 1, No. 1 appeared in Jan., 1924. Publ. monthly by the Pullman Publishing Co., Pullman Bldg., New York, N. Y. (*C. A.*)

CERAMIC ABSTRACTS

Compiled by the

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Emily C. Van Schoick, Asst. Editor

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[1] The abbreviation (*C. A.*) at the end of an abstract indicates that the abstract was secured from the editor of *Chemical Abstracts* by coöperative agreement.

Cement, Lime and Plaster

Calcium sulphate cement. C. L. Haddon and M. A. W. Brown. *J. Soc. Chem. Ind. Trans.*, **43,** 11T–16T(1924).—The principal objects of research were: (1) To det. the number of allotropic modifications of anhydrous calcium sulphate; (2) To explain differences in setting properties of calcium sulphate from different sources; (3) To exam. the acceleration of setting by other sulphates; (4) To investigate the nature of intercryst. adhesion. (1) Van't Hoff distinguished two forms of anhyd. $CaSO_4$, one of which he called "sol. anhydrite." H. and B. conclude that only one modification of $CaSO_4$ exists; its soly. at 33°C is 2.29 g. per l. and in 5% copper sulphate soln. 2.08 g. per l. (2) The diff. setting rates of diff. plasters are due to particle size and percentage of hemihydrate. Flooring plaster consists of anhyd. $CaSO_4$ and hemihydrate. Anhyd. $CaSO_4$ absorbs moisture from the air to form hemihydrate, the speed depending on the particle size. Agglomeration of particles is increased by intensity and duration of heating. Growth of particles is due to the particles adhering and not to finer particles dissolving and repptg. The influence of external conditions is also shown. (3) Rohland's theory that salts which increase the soly. of $CaSO_4$ increase the setting speed and *vice versa* is shown to be incorrect. Borax, which retards the setting of plaster, increases the soly. of gypsum. $CaSO_4$ dissolves and ppts. more readily in presence of copper sulphate. (4) Rosenhain enunciated the theory of the existence of a powerful intercryst. cement, amorphorus in nature, and F. C. Thompson put forward an alternative surface-tension theory. The evidence obtained supports R. Setting is caused by the interlocking of needles of pptd. dihydrate, and by crystal adhesion due to amorphous cement which dissolves in certain solvents with corresponding loss of mechanical strength. H. H. S.

Magnesium oxychloride cement. J. H. Paterson. *J. Soc. Chem. Ind.*, **43,** 215–8(1924).—Sorel's cement is the strongest cement available on a large scale. It can be made nearly twice as strong as Port. cement, and can bind together very large volumes of filling mats., such as sand for concrete or sawdust for floor covering. It consists of the compd. $3MgO.MgCl_2.10H_2O$ mixed with solid solns. of a more basic nature. If the temp. of burning magnesite is carried above 1000°C the resulting MgO will not react with $MgCl_2$. Chem. analysis cannot detect overburned MgO in a consignment; thus a mat. of satisfactory chem. compn. may be useless for cement making. $MgCl_2$ is best used at 22° Bé.; at 24° it causes the setting cement to expand and destroy the molds or blister the floor. The amt. of $MgCl_2$ added is only about half of the chloride reqd. to combine with the MgO. Specif. for the cement are suggested, viz: *Tensile strength* 500 lbs. per sq. in. after 7 days and 850 lbs. after 28 days, with a mixt. of 1 pt. MgO, 2 pt. fine ground SiO_2 and 5 pt. standard sand sufficiently wetted with $MgCl_2$ to be molded into standard briquettes of cement-testing machine type; *Wet strength* should not be less than 30% of dry strength; the briquettes are sprayed with water 3 or 4 times in 8 hrs. and then tested; *Setting time* is detd. with a Vicat needle; the initial set should not take place before 90 min. and the final set should be attained within 8 hrs.; *Expansion* if over 0.3% within 24 hrs. of initial set is questionable. Free lime in the MgO reduces the wet strength. (Ref. is made to Seaton, Hill and Stewart, *Chem. and Met. Eng.*, 1921.) H. H. S.

Magnesium oxychloride cement. H. H. Dains. *J. Soc. Chem. Ind.*, **43,** 284 (1924).—D. questions Paterson's statement that magnesite is dead-burnt for cement purposes at 1000°C. A temp. of 1500°C would be required. H. H. S.

The Internat. Cement Congress (*Jour. Soc. Chem. Ind.*, **43,** 240(1924)).—Arranged by the Instn. of Structural Engnrs. in London, Eng. April 22 and 23, 1924, discussed the following subjects: (1) Cement fondu in practice, (2) surface dust on concrete floors in factories, (3) Cement in sea-water, (4) Cement in concrete roads, (5) Preparations to withstand oil, (6) Influence of size and shape in compression test-

blocks, (7) Microscopy of cement, (8) Porosity of concrete blocks, (9) Use of sea-water in mixing cement. H. H. S.

Cement and Lime Co. Works—(Queensland). ANON. *Indus. Aust. and Min. Jour.*, **71,** 659(1924).—Situated at Darra, 10 miles from Brisbane. Limestone obtained from quarries at Gore. A full description is given of the works and methods employed. The works now consist of 2 complete units capable of an annual output of approx. 60,000 T. per annum. O. P. R. O.

Super-cements. RICHARD GRÜN. *Zement,* **13,** 27–30, 39–41(1924).—Three types (1) the quick setting special portland cement, (2) high-calcium cements, and (3) high-alumina or cement fondu are discussed. In (1) only pure raw mats. finely ground and carefully burned, are used. In two days the strength attained surpasses the usual 28-day demands. Tricalcium silicate is probably the chief constituent. Group 2 depends upon the fineness of its raw material particles for its somewhat greater strength. The CaO content lies between 65% and 74%. In (3) calcium aluminates replace the usual silicates. The chief distinction from portland cement lies in the high initial set and the resistance to most salt solns. In some expts. with high-alumina (30%–50%) cements, G. explains the variations due to differences in burning as well as in the compn. The effect of cooling rates and modes is also studied. H. F. K. (*C. A.*)

Miscroscopic examination of raw and calcined gypsum. E. S. LARSEN. *Proc. Am. Soc. Testing Materials,* **23,** I, 236–43(1923).—A miscroscopic description including form of crystal, *n*, etc., is given for the minerals most commonly found in raw gypsum, *viz.*, gypsum, quartz, anhydrite, calcite, and clay. The changes which occur in these constituents during calcination are discussed and the $CaSO_4.^1/_2H_2O$ formed is described miscroscopically. A method for the estn. of anhydrite is given. J. C. W. (*C. A.*)

BOOKS

KLOES, J. A., VAN DER: **Onze Bouwmaterialen.** 3rd ed., 6 volumes. Amsterdam: L. J. Veen. Guilders 50.00. Reviewed in *Arch. Suikerind.*, **32,** 219(1924). (*C. A.*)

MENEGHINI, DOMENICO: **Chimica applicata ai materiali da costruzione.** Padua: Litotipo-editrice Universitaria. 279 pp. L. 25. (*C. A.*)

MÖRSCH, E.: **Teoria e pratica del cemento armato.** 2nd ed. revised. Mailand: U. Hoepli. 691 pp. L. 54. (*C. A.*)

PATENTS

Cement. R. DÉCOLLAND. Brit. 211,497, Feb. 14, 1924. Aluminous cements are made in ordinary rotary kilns by (*a*) lengthening the heating zone, and (*b*) preventing the formation of a coating due to the fusing of the fuel ashes. The lengthening of the heating zone is accomplished by employing as a fuel a coal such as lignite which contains a large proportion of volatile neutral products, or by diluting the roasting atm. with water-vapor or other neutral gas. The formation of a coating of fused ashes is prevented by mixing with the fuel a sufficient proportion of limestone to combine with the SiO_2, Fe, etc., and render the ash refractory, or by removing the refractory lining of the kiln at the point of formation of the fused ash, and cooling the plating by external means. (*C. A.*)

Slag cements. H. ANDREWS. Brit. 211,517, May 22, 1923. Lime, with or without other substances such as SiO_2 and Fe ore, is mixed with molten blast-furnace slag, and the mixt. is fed into a rotary kiln at 1500°. The waste gases from the kiln are utilized to burn limestone for the production of the lime used in the process. The clinker is ground with or without an addn. of 30–50% of granulated slag. (*C. A.*)

Preparing sawdust for use in concrete, etc. E. L. ZUKOSKI. U. S. 1,490,719, April 15. Sawdust is treated with a Na silicate soln. and then washed in order to remove substances such as would interfere with the setting of cement. Cf. *C. A.* **18,** 158. (*C. A.*)

Coated waterproof sheeting. L. Kirschbraun. U. S. 1,489,254, April 8. A waterproof material adapted for use as a *roofing* is formed of felted fibrous sheets satd. with a bituminous binder and coated on one side with bitumen, fiber and an emulsifying agent, *e. g.*, a mixt. of fiber, asphalt, clay and H_2O. Cf. *C. A.* **18,** 742. (*C. A.*)

Protecting wooden piling from teredos. C. P. Tatro and G. Delius. U. S. 1,489,798, April 8. Submerged piling is protected from attack by teredos by placing an anode in the water adjacent the pile and passing a current between it and a more distantly placed cathode. (*C. A.*)

Terminal for electrolytic devices. G. Delius and C. P. Tatro. U. S. 1,489,743, April 8. Structural features of a device for electrolysis of sea water to protect piling. (*C. A.*)

Road material. G. W. Butler and C. Williams. Brit. 211,205, Nov. 13, 1922. The special ferro-silicate known as "copper slag" found in the neighborhood of Swansea is intimately mixed with a tarry or bituminous binder to form road macadamizing for paving material. The % compn. of the slag is SiO_2 60.6, Fe_2O_3 33.48, CaO 2.80 MgO 1.00, S 0.54, with traces of Cu and Sn. (*C. A.*)

Enamel

Japanning license plates. Elmer C. Cook. *Fuels and Fur.*, **2,** 695–6(1924).—Describes methods and equipment used in modern plants at state prisons for making motor vehicle license plates. W. E. R.

Unique pickling system—humidity driers cut costs in enameling plant. Anon. *Cer. Ind.*, **3** [1], 22(1924).—(The Columbian Enameling and Stamping Co., Terre Haute, Ind.)—Single coated grayware and triple coated whiteware are produced. Small wooden carts are used to carry the raw mats. from the bins, over the scales to the rotary mixer in 1500-lb. batches. The batches are mixed for 2 mins. and elevated to 12000-lb. storage hoppers. A conveyor bucket carries the mixed raw mats. in 1100-lb. batches to the smelting room. The smelting is done in 2 tilting rotary furs., the combined daily capacity of which is 9 batches of 850 lbs. each, the time required being $2^1/_4$ hrs. The frit storage bins are calibrated in order to facilitate the taking of inventory. Fourteen 5-ft. ball mills are provided for frit grinding. The frit is ground in 1000-lb. batches until a test shows it has been ground sufficiently, which requires about 10 hrs. The test is made by drawing a 100 cc. sample of enamel, through a one-inch pipe inserted permanently in the mill, mixing it with a given vol. of water and allowing it to settle in a graduate for one min. The ground enamel is unloaded from the mills with the aid of compressed air into zinc lined carts which transfer the enamel into storage tanks in the dipping room. The annealing of the metal which is necessary after two or three draws is done in a continuous furnace at 1500°F. The completed metal shapes are sent through a continuous scaling furnace at 1300°F. Dovetailed wooden pickling baskets are used, each having an average capacity of 100 pcs. of ware. Rubber straps and a hand windlass are used for lowering and raising the baskets. The ware is kept in a sulphuric acid bath for 10 mins., rinsed in water and placed in a soda neutralizing bath. The acid tanks are built of 3-inch cypress with pitch-calked joints. The soda and water tanks are built of 2-inch pine with calked joints. A chain drier conveys the carts of pickled ware into the dipping and spraying room. The enamel is fed to the spray guns under a four foot gravity head and atomized with an air pressure of 80 lbs. Individual dipping and spraying booths are used. The triple coated ware is dried in driers at 180°F whereas the grayware is dried in the open. Each of the eight driers holds six trucks with a combined capacity of from 1200 to 1500 pcs. of ware. Ware requiring from 2 to 3 hrs. to dry in the open are dried in 15 mins. in the drier. There are twelve coal fired furnaces of the recuperator type equipped with fire-clay muffles

and carborundum hearths. The grayware is fired at 1700°F, the triple ground coat at 1750°F, and the cover coats at 1600°F. An optical pyrometer is used to measure the temp. All furnaces average 15 loads per hr. and operate on a 24 hr. schedule. The furnaces operg. at 1700°F produce 6 tons of ware every 24 hrs. on 3600 to 4000 lbs. of Indiana coal screenings bought at $2.00 per ton. P. D. H.

The second annual report of the British Cast Iron Research Association. Pp. 19. Birmingham, Eng.: The Birmingham Printers, Ltd. 1923. H. H. S.

Glass

New process anneals window glass in ten mins. ANON. *Cer. Ind.*, **3** [1], 17 (1924).—(Interview with Mr. Frank Bastin, Pres., Blackford Window Co., Vincennes, Ind.) This is the first plant built especially for the manuf. of window glass by the Fourcault process. Belgian glass experts have been employed. A plant is maintained for the manuf. of their own refracs. The raw "debiteuse" mixt. is ground in a dry pan to pass 16-mesh, pugged several times and stored in masonry bins. The "debiteuse" are dried for 3 mos. in an open room and fired to 1900°F in 6 days. Modern bins for the storage of raw glass mats. have a combined capacity of 44 cars. The unloading is done mechanically. The raw batch is gathered by an elec. operated car containing a mixing mill and scale. The batch is mixed for 5 mins. and elevated to a 43-ton capacity batch hopper also provided for cullet storage. Fifteen batches of 1500 lbs. each are fed to the furnace daily. The tank proper is composed of 2 tanks built in the shape of the letter "T" and connected by a canal. The dimensions of the melting tank are 21′ x 85′ by 5 blocks in height. The height of the glass in the drawing tank is 36″. The tanks are water and air cooled. The melting tank has a capacity of 800 tons of molten glass. It requires 72 hrs. for the glass to reach the machines. The melting temp. is 2650°F, the temp. in the canal is 2100°F, and the glass is drawn from the feeder tank at 1900°F. The special machines, which are set in a vertical position, may be regulated to draw glass of any thickness from $^1/_{16}$″ to $^1/_2$″ by changing the speed of the asbestos rollers. The sheet is 44″ to 52″ in width. The glass is annealed in a 20 ft. leer and acquires a beautiful natural polish. Four operators watch each machine, two the drawing and two the annealing process. Two men attend to two machines on the cutting floor. The fuel used is producer gas. The coal is crushed to nut size for the producers and the oversize is used under the boilers in the development of their own elec. power. P. D. H.

Determination of glass ware temperatures. JAMES VOORHEES. *Fuels and Fur.*, **2**, 679–81(1924).—For detg. the av. temp. of pieces of glass ware leaving the mold, or calcg. heat lost by ware between mold and leer, the construction and opern. of a simple calorimeter is described and the calculations involved explained. W. E. R.

Some notes on pot-clays and the manufacture, use, and treatment of glass-house pots. PERCIVAL MARSON. *Jour. Soc. Glass Tech.*, **8**, 29, 45(1924).—The author relates some of his experiences with glass-house pots and pot-clay mixt. The requisite characteristics of a pot clay are outlined and several tests are given. A combination of the treading process and the pugmill process is recommended for tempering. Methods of mfg. pots, arching pots, setting pots, and the prevention of stones in pots are given. J. G. P.

Specifications for glass. W. E. S. TURNER. *J. Soc. Chem. Ind.*, **43**, 92–93(1924).—The charge that glass splinters from food containers is a cause of appendicitis and cancer is, after consultn. with leading pathologists and surgeons, very definitely refuted. H. H. S.

BOOK

Directory for the British Glass Industry 1923. Soc. of Glass Technology, Sheffield. Price 7S. 6d.—Alphabetical list of glass mfrs., makers of scient. and optical app., crafts-

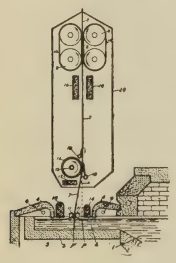
men, firms making plant app. and raw mats., trades unions and other assocns., and periodicals abstracted. H. H. S.

SCHULZ, HANS: **Das Glas.** Kempten: Kosel & Pustet. 180 pp. (*C. A.*)

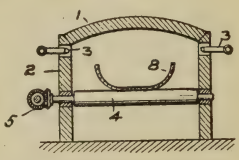
ZSCHIMMER, EBERHARD: **Chemiebüchlein des Glasschmelzers. Zum Selbstunterricht.** Jena: Thuringer Verlagsanst. u. Druckerei. 86 pp. (*C. A.*)

PATENTS

Drawing and flattening sheet glass. CLIFFORD A. ROWLEY. U. S. 1,499,406, July 1. In an app. for drawing and flattening sheet glass, a receptacle containing a mass of molten glass, means for drawing a continuous sheet of glass upwardly therefrom, a deflecting member for the sheet positioned between the molten glass and the drawing means, and having its sheet engaging surface in vertical alignment with the sheet engaging surface of the drawing means, and a pair of coolers one at either side of the sheet source, the cooler at the side beneath the deflecting member having the greater heat absorbing capacity.



Process of flattening glass sheets. HARRY G. SLINGLUFF. U. S. 1,497,798, June 17. A process of flattening sheets of glass having polished surfaces and a curvature which it is desired to remove and in which the glass has a temp. below that at which it sets, which consists in moving the sheets continuously ahead in a heated chamber on constantly shifting points of support, exposing the sheets to a temperature such as to cause them to flatten of their own wt. and then exposing the sheets to progressively decreasing temp. to permit them to set as they move along.



Process of flattening glass sheets. HARRY G. SLINGLUFF. U. S. 1,497,799, June 17. The process of flattening a parti-cylindrical sheet of glass which consists in moving the sheet continuously ahead endwise with its convex sides down on constantly shifting points of support, exposing the sheet to a temp. such as to cause it to partially flatten of its own wt. then applying pressure downwardly on the sheet along constantly shifting lines to further flatten it, and exposing the sheet to progressively decreasing temp. to permit it to set as it moves along.

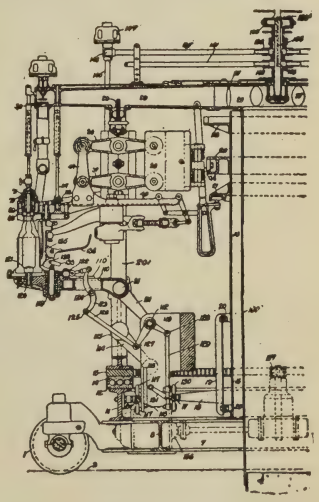
Glass-molding machine. WILLIAM G. BERGMAN. U. S. 1,499,334, July 1. The combination with a glass fur. having a discharge neck of a glass molding mach. having a set of finishing molds on each side of said neck, a single blank mold for each set of finishing molds, means for intermittently reciprocating said blank molds constructed and arranged to cause the blank mold for each of said sets to be reciprocated into alternate engagement with said discharge neck and its respective finishing molds to deliver a charge of molten glass to said finishing molds, means to release said charge from said blank mold as it is moved into engagement with its respective finishing mold, means to move said finishing molds into position to be engaged by said blank molds simultaneously with the movement of said blank molds, means to hold said finishing molds against movement during the stoppage of reciprocation of said blank molds, and means to admit fluid pressure alternately to each set of said finishing molds while said blank molds and finishing molds are stationary.

Machine for the manufacture of glass articles. ROBERT FREDERICK HALL. U. S. 1,499,522, July 1. In a mach. for the manuf. of glass articles, the combination of a fixed base, a ring mounted rigidly upon the said base, the said ring forming a lower

member of an anti-friction bearing, another ring rotatable with respect to the first mentioned ring and forming the upper member of the anti-friction bearing, hollow columns mounted upon the second mentioned ring, hollow radial arms in connection with the said hollow columns, such radial arms being also connected to an air supply, mechanisms carrying a parison mold mounted upon the said hollow columns, downwardly extending hollow forks in connection with the hollow radial arms, such forks being provided with apertures to enable cooling air to be supplied to the outside of the molds and parts to be cooled, and means for cutting off the supply of cooling air at appropriate times, substantially as described.

Machine for the manufacture of glass articles. ROBERT FREDERICK HALL. U. S. 1,499,523, July 1. A machine for the manuf. of glass articles comprising a stationary frame, a rotatable frame supported thereon, said rotatable frame including an upper member having a plurality of laterally extending radial arms, and a lower member, a removable vertical column interposed between each radial arm and the lower member and connected therewith, each of said columns having a vertically elongated opening therein, a parison mold supporting frame journaled in means in the elongated opening, a parison mold thereon, a finishing mold carrying frame journaled in the elongated opening, a finishing mold carried thereby, and means for effecting the actuation of the parison and finishing molds, the arrangement being such that when one of the columns is removed, the parison and finishing molds and their associated parts may also be removed independently of the similar parts carried by the other columns.

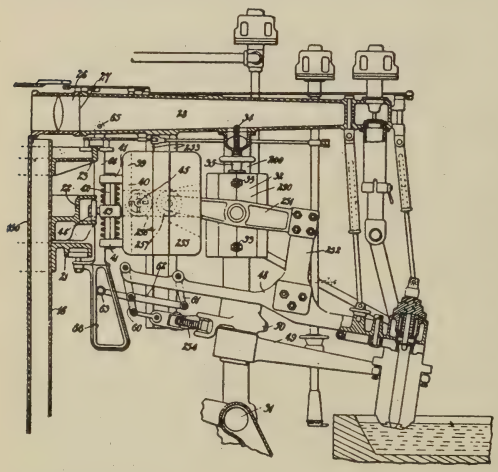
Machine for the manufacture of glass articles. ROBERT FREDERICK HALL. U. S. 1,499,524, July 1. In a rotary mach. for the manuf. of glass articles, the combination of a rotatable framework, rotatable about a fixed central column, a secondary frame adapted to slide vertically with respect to the said framework, in order to adjust the machine for parison molds of different lengths and for different levels of the molten glass, means for so adjusting the said secondary frame and for retaining it in various vertical positions, two levers of the first order, of equal length, one pivoted above the other to the said secondary frame, a link pivotally connected to the outer ends of the said levers, another link pivotally connected to the inner ends of the said levers, so as to constitute a parallel link lever mechanism of the first order, a sectional parison mold carried from the outer link, means operg. upon the inner link for lowering and raising the parison mold at appropriate times, such means being adjustable in order to regulate and accommodate the dipping according to the various adjusted positions of the secondary frame, substantially as described.



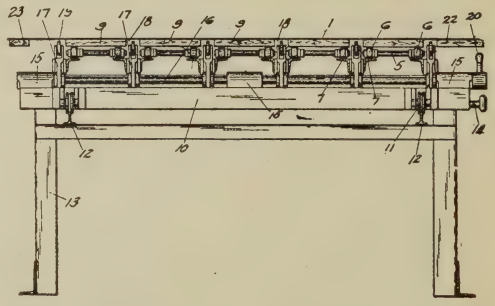
Machine for the manufacture of glass articles. ROBERT FREDERICK HALL. U. S. 1,499,525, July 1. In a mach. for the manuf. of glass articles, the combination of a rotatable framework, a lever of the first order pivoted to the said framework, a sectional finishing mold carried by the outer arm of the said lever, a link pivoted to the inner arm of the said lever, another link pivoted to the first mentioned link, parallel to the inner arm of the lever and pivoted to the framework so as to constitute a parallel link lever mechanism, means for raising and lowering the lever at appropriate times, a toothed quadrant pivoted to the outer arm of the lever in proximity to the finishing mold, said toothed quadrant carrying a fork adapted when swung over to embrace the top of the article being

finished, another toothed quadrant meshing with the first mentioned quadrant and also pivoted on the outer arm of the lever, and a rod connecting the latter quadrant to a portion of the framework in such a way that as the finishing mold opens, the said fork engages the top of the article, substantially as described.

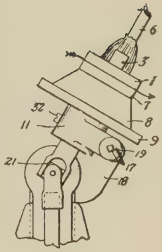
Machine for the manufacture of glass articles. ROBERT FREDERICK HALL. U. S. 1,499,526, July 1, 1924. In a machine for the manuf. of glass articles, the combination of a fixed central column, a framework rotatable about the said central column, a secondary frame adapted to slide vertically with respect to the said framework, in order to adjust the machine for different lengths of parison molds and for different levels of molten glass, means for adjusting the said secondary frame and for retaining it in various vertical positions, a lever of the first order pivoted to the said secondary frame, a sectional parison mold, the sections of which are pivotally carried in fixed relation to the outer arm of the said lever, a counterbalance weight in connection with the inner arm of the said lever, means in connection with the said inner arm of the said lever for lowering and raising the parison mold, link mechanism for opening and closing the said parison mold, an arm in connection with and adapted to operate the said link mechanism, a depending arm pivoted to the rotatable framework of the machine, a tapering slot at the lower end of the said arm, means on said arm engaging the said tapering slot, a horizontal box cam in connection with the said central column, and a follower to the said cam, connected to the said depending arm, substantially as described.



Cracking-off device for sheet glass. JOHN H. MOLLER. U. S. 1,499,393, July 1. The combination with a table on which sheet glass is supported while being scored, of a cracking-off device movable to different positions beneath the table and sheet to elevate the sheet at the score line. The combination with a moving table or conveyor on which the glass sheet is carried while being scored, of a cracking-off device movable to position beneath the score line and comprising means to elevate the sheet.

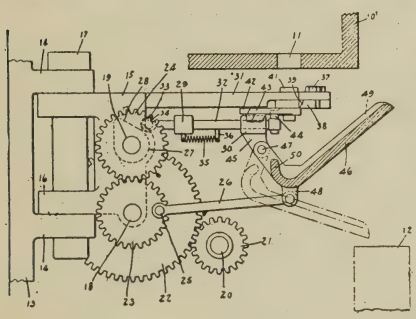


Process for the treatment of silicate compositions. ROBERT L. FRINK. U. S. 1,497,263, June 10. The process of producing a mixed silicate suitable for use in glass manuf. which consists in subjecting a silicate and an alk. metal chloride to the action of heat and a decomposing gas, and treating the resulting reaction mixt. with an active alkaline earth contg. reagent in controlled amounts to partially decompose the same.



Glassworking mechanism. NOBLE W. HARTMAN. U. S. 1,497,332, June 10. The combination with a blow-pipe and a carrying mechanism therefor, of a marvering device comprising a pair of juxtaposed members forming therebetween an aperture of predetd. shape, at least one of said parts being loosely mounted and adapted to be driven by the charge of glass on said blow-pipe during its passage through the said aperture and to roll the said charge of glass into a shape similar to that of the said aperture.

Glass flowing and shearing device. EDWARD MILLER. U. S. 1,497,929, June 17. In a glass flowing and shearing device, the combination with a glass discharging spout, and a glass receiving mold, of shearing means positioned beneath said spout, said shearing means comprising a pair of shearing members, yielding means normally maintaining said shearing members in the open position to permit said glass discharging spout to discharge glass through the same, means for closing said shearing means in opposition to said yielding means for severing the glass passing through said shears, a pivotally supported spoon positioned beneath said shearing means and adapted to receive the severed glass therefrom, means for tilting said spoon to deposit the severed glass into the mold, and means for simultaneously actuating said shearing means and said spoon tilting means in timed relation.



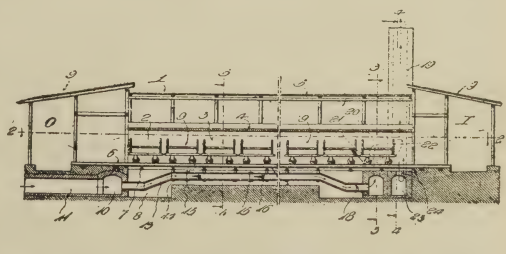
Heavy Clay Products

Bricks from ground clinker. ANON. *South Africa Jour. of Industries*, **6**, 433(1923).—Ground clinker, mixed with $^1/_9$ of its wt. of cement, is being used for making bricks at the municipal gasworks at Würzburg, Germany. By this method, 8 cu. yds. of good building mat. are produced from $^1/_2$ cu. yd. of cement, with an energy-consumption equivalent to about 13 lb. of coal, and are produced at half the cost of ordinary bricks.

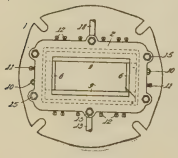
O. P. R. O.

PATENTS

Clay-products drier. ROBERT THOMPSON KYLE. U. S. 1,499,227, June 24. A drier comprising a plurality of tunnels having ware inlets at one end and ware outlets at their other ends, a cross flue under the outlet ends of said tunnels, and a hot air inlet for said cross flue, a second cross flue under the inlet ends of said tunnels, a plurality of heating pipes extending from the first to the second named flue, the space around said pipes being in open communication with said tunnels, a third cross flue adjacent said second flue, the crown of said third flue having openings communicating with the inlet ends of said tunnels, a stack rising from and communicating with said third cross flue, and a fan for drawing air from said second flue and forcing it into said stack.



Die for brick machines. Lloyd W. Brown. U. S. 1,497,669, June 24. An extrusion die for brick machines, comprising, in combination with a substantially rectangular hollow head, a plurality of complemental die members forming each the top, bottom and sides of the die, the members composing each the top and bottom of the die having their ends overlapping the ends of the members of said sides, and means for adjusting the positions of each of the members of the sides with respect to the adjacent walls of said head.



Refractories

Note on the influence of rapid cooling on the reversible expansion of fireclay. H. S Houldsworth. *Jour. Soc. Glass Tech.*, **7**, 29, 30(1924).—Test pieces of Farnley fire clay were fired to cones 9 and 14–16, held at these respective temps. for 2 hrs., and pieces from each burn were subject to different cooling rates. The methods of cooling included: plunging in cold water, cooling in air, and allowing them to cool slowly in a fur. for 17 hrs. The reversible thermal expansions of the specimens were then determined. In the case of the pieces fired to cone 9 very little difference was noted in the expansions of the pieces cooled at varying rates. In the case of the pieces fired to cone 14, the reversible thermal expansion of the test pieces cooled rapidly differed considerably from that of the slowly cooled specimen. The latter showed a more rapid rate of expansion from 100–200 °C, and from 550–600 than in the other temp. ranges examined, due presumably to the volume changes associated with the alpha-beta cristobalite (or tridymite) and quartz changes, respectively. The rapidly chilled specimens were then reheated in a muffle for 6 hrs. at 950 °C and their reversible thermal expansions determined after cooling. This treatment did not affect the thermal expansions of the specimens. The slowly cooled and rapidly cooled clays on being reheated to cone 12 for 2 hrs. and allowed to cool slowly in a fur. showed considerable change in their expansion-temp. curves. The expansion from 100–200 was now considerably greater than was that previously obtained for the slowly cooled test pieces, while the expansion at 570 due to the alpha-beta quartz inversion was reduced somewhat. The effect on cold crushing strength of varying rates of cooling was detd. It was found that the cold crushing strength was reduced by nearly 30% as a result of rapid cooling, although the actual cold crushing strength is still considerable. J. G. P.

Madagascar graphite. A. D. Lumb. *Bull. Imp. Inst.*, **20**, 61–68(1922).—Production of graphite in Madagascar began in 1907 with an output of 8 T. and increased to 35,000 T. in 1917, but has since fallen off considerably owing to post-war depression. It is of the flake variety and occurs in schists and gneisses in the older cryst. rocks, which extend over two-thirds of the island. About 60% is considered of crucible grade. The mines are worked entirely by natives with European supervision for the larger enterprises. The sepn. of the pure graphite from the gangue is a rather difficult matter principally owing to the presence of mica, which is of nearly the same sp. gr. as graphite and occurs in the same flaky form. In the early stages of the industry the method of treatment was very primitive, the process consisting in washing the mat. in a wooden trough, drying in the sun, panning, and sifting in a hand-sieve. Recent practice makes use either of a dry method, or a wet method, or a combination of the two, and a final concentration by oil flotation. This last treatment ensures a satisfactory separation of the mica and silica from the refined product. The Ceylon and Madagascar deposits are the most important in the world. Although the Ceylon is slightly superior in grade, the Madagascar can be mined much more cheaply and so can be sold at a much lower price. O. P. R. O.

Refractories for coke ovens. W. J. Rees. *Coll. Guardian*, **119**, 378(1920).—As a

preliminary to the discussion of properties desirable in bricks for coke ovens, Rees states the general conditions of their use: (1) *Temp.*—The temps. which bricks have to stand are not, in comparison with those met with in other industrial operations, high. In the heating flues the max. temp. under ordinary conditions of coking is not likely to exceed 1350°C. (2) *Load.*—The load is not sufficient to lower the refractoriness of any of the bricks in general use. (Brief reference is made to effect of load on the refractoriness of fire-clay and silica bricks.) (3) *Permeability of Gases.*—The bricks must become fairly gas-tight, and the cement used must also at the temperature of coking produce gas-tight joints. (4) *Resistance to abrasion.*—The bricks must be mechanically strong enough at coking temp. to resist the abrasion of the insertion and withdrawal of the charge and also the abrading action of the hot gases. (5) *Resistance to corrosion.*—This is perhaps the most important factor with which it is necessary to deal; compn. and amt. of impurities present in the coal which are likely to act as corrodants. (Mr. Rees' full report of this appears in *Coll. Guar.*, **117,** 1278(1919).) Taking the Tinsley Park figs., there will be carried into the oven, with each charge of slack and adhering water, approx. 50 lb. of sodium chloride and 20 lb. of sodium sulphate. The salt present will begin to volatilize at 800°C, and in addition to this removal of salt by volatilization, there will be some removed by hydrolysis as steam from the center of the charge comes in contact with the hot coal. In the coke oven the salt vapor, instead of reacting with the surface of the bricks, will penetrate them: there may be some deposition of salt inside the brick, and some of the vapor may pass on to it until it reaches a zone in the brick at which the temp. is high enough for interaction to take place with some rapidity. The joint result of the slower interaction in the cooler portion of the brick and the more rapid action in the hotter zones, will be the formation of a weak spongy mass, which is becoming increasingly more open to the attack of the salt, and which may fall away, or be dragged away, by the moving coal or coke. Another impt. phenomenon in connection with this corrosion, to which attention has been previously drawn by Fearnsides is the very general presence of a layer of hematite in that portion of the brick where disintegration and shearing of the brick are taking place. This is probably due to the formation and volatilization of ferric chloride by the action of the salt vapor on iron oxide, present either in the coal or more probably in the bricks. This vapor will penetrate the porous bricks until it reaches a zone in the brick to which oxygen, containing gases from the combustion flues, penetrate, and it will then be decomposed with the formation of hematite which will be deposited. Besides the disruption due simply to chem. attack, disruption may take place due to the fact that the corroded part will have a different coeff. of expansion to the remainder of the brick, and with the repeated heating and cooling of the oven wall, the differential expansion and contraction may cause a falling away of the corroded portion of the brick. An example of the corrosive action of salt came under the writer's notice in connection with expts. on the effect of heat on mixt. contg. salt, limestone and sand. At temps. of 1350° to 1400°C, the clay lining of the contg. vessel was very rapidly corroded. The clay was replaced by a silica lining, and the corrosion was very considerably reduced. The exptl. evidence indicates that salt corrosion is likely to be much more severe on fire-clay bricks than on either alumina or silica bricks. American practice has been largely in the direction of the use of silica bricks; there are, perhaps, factors in connection with the size, construction and general coking practice which have minimized the difficulties of their use. In making silica bricks it is necessary to add to the crushed silica rock some mat. which will, at high temperature, act as a bond; the mat. almost invariably used is lime. This addn. of lime reduces the refractoriness of the silica, and the propn. which can be used, depends on the size of the fragments of quartz, and on the impurities present in the silica rock. The size and grading of the fragments of silica for coke oven bricks, and the compn. of the matrix are of paramount importance. Le Chatelier, in France, carried on exptl.

work, which definitely indicated that by substituting for ordinary fine material used in making brick, an impalpable powder obtained by grinding the raw silica rock in a tube-mill, a brick of distinctly superior physical properties could be produced. Test bricks were made, which were burned at approx. 1500°C, and the foll. results were obtained from them in standard tests:

Compn. of mixt.	Linear expansion per c.	Density		Crushing strength in kilogs. per sq. cm.		
				Cold		At 1600°C
		Apparent	Real	Dried	Burnt	
75 crude quartzite 25 impalpable quartzite 2 lime	5.2	1.63	2.35	15	165	30
75 crude quartzite 25 fine quartzite 2 lime	...	....	2.33	10	60	8
25 crude quartzite 75 impalpable quartzite 2 lime	3.9	1.36	2.35	9	135	10
25 crude quartzite 75 impalpable quartzite 2 lime	...	....	2.33	6	52	3

The superiority of the brick contg. 25% of the impalpable quartzite powder is very apparent. This exptl. work has been amplified in this country (England), and it has been proved on the large scale that by using a silica rock which, on crushing, gives angular fragments, by suitably grading these crushed fragments and by mixing them with a definite propn. of impalpable silica powder (with which a bonding mat. has been mixed) bricks can be made which have a very satisfactory texture, and in which the after-expansion during use is small. The foll. is an anal. of a silica brick which has a satisfactory phys. constitution, but it is obvious from the foregoing that, within limits the texture and mineralogical constitution of the brick are of more importance than its chem. compn.:

	Per cent		Per cent
SiO_2	95.16	MgO	0.15
Al_2O_3	1.29	K_2O	0.51
Fe_2O_3	0.78	Na_2O	0.24
TiO_2	0.15	Total	100.16
CaO	1.88		

The condy. from heat of the refractory mat. used for the coke oven is a factor which needs some consideration. Measurements and experience in American coke oven practice indicate that at coking temps., the condy. of a good silica brick is decidedly greater than that of a fire clay or semi-silica brick, which should be another point in favor of the use of silica brick in coke oven construction. (This paper was given before the Midland Section of the Coke Oven Managers' Assn., with further discussion, page 454, *Coll. Guardian.*) O. P. R. O.

Refractory materials. J. W. Mellor. *Coll. Guardian*, **117**, 479, 537, 719, 775 (1919).—Synopses of a series of lectures given by Dr. Mellor before the Soc. of Chem. Indus. dealing with the development and problems peculiar to the refrac. mats. problem. O. P. R. O.

Fire clay and silica brick as gas-house refractories. A. F. GREAVES-WALKER. *Gas Age-Record*, **53**, 567–70(1924).—U. S. resources of refractory fire clays are given; Georgia surpasses all other states in quantity of reserves. Mfg. methods for fire-clay brick are outlined. Requirements for gas house refractories are listed and most salient features pointed out. The characteristics of silica brick are listed and discussed from the viewpoint of gas-house refractories. H. G. B. (*C. A.*)

Tests on clays for making zinc retorts. K. ENDELL AND W. STEGER. *Metall u. Erz*, **20**, 321–31(1923).—Tests on a no. of German, Belgian, and American clays have been carried out to det. their suitability for making zinc retorts. Detns. were made of the chem. and rational compn., the shrinkage on drying and the softening point of the raw clay, the linear shrinkage and porosity of the clay after firing to 1000°, 1100°, 1200°, 1300°, and 1450°, and the softening point of a mixt. of equal parts of grog and clay under load at high temps. The plastic ball clays tested contained over 95% of clay substance and the lean clays between 50 and 75%, but the plasticity and shrinkage on drying were not propl. to the amt. of clay substance present. The ball clays, with the exception of the Amer., attained their max. and linear contraction at 1100°, while the leaner clays continued to shrink slowly with further rise of temp. The fusion point lay between cones 28 and 34 (1630–1750°) and was independent of the content of clay substance. The softening point of mixts. of clay and grog under load was higher the higher the SiO_2 content of the grog. Six retort mixts. after firing at 1000° showed values for the tensile strength between 9 and 66 kg. per sq. cm., the latter being found in the Amer. mixt. owing to its high content of Fe_2O_3 (3.88%) and TiO_2 (1.48%). The shrinkage on firing, porosity, and fusion point of all the mixts. were practically the same, but the German (Silesian) mixt. softened under load about 100° below the others. Clay mixts. contg. 60% to 80% of SiC softened about 100° higher than the grog mixts., but had the same porosity. J. S. C. I. (*C. A.*)

Determination of thermal conductivity of refractories. M. D. HERSEY AND E. W. BUTZLER. *J. Wash. Acad. Sci.*, **14**, 147–51(1924).—See *C. A.*, **18**, 889. C. H. K. (*C. A.*)

Some Italian magnesite deposits. G. CASTELLI. *Rass. min. met. chim.*, **60**, 5–8 (1924).—Several $MgCO_3$ deposits of special value are described stratigraphically. *Castiglioncello.* The product, which is hard and white, analyzed in %: $MgCO_3$ 88.72, SiO_2 3.40, Fe_2O_3 1.80, CaO 3.15, MgO 42.45, H_2O and loss of ignition 49.20%. Large amts. valuable in metallurgy and for the prepn. of Mg salts are available. *Monterufoli.* Because of impurities the material is useful only after special sorting. Av. compn.: $MgCO_3$ 86.02, $CaCO_3$ 9.60, Fe_2O_3 + Al_2O_3 2.71, insol. in HCl 1.67%. *Island of Elba.* Av. compn.: $MgCO_3$ 84.50, $CaCO_3$ 1.00, SiO_2 11.00, Al_2O_3 0.50, Fe_2O_3 0.90, H_2O 2.10%. *Querceto.* These are the most important deposits in Italy. The best material has the av. compn.: $MgCO_3$ 97.19, $CaCO_3$ 0.93, SiO_2 1.12, Fe_2O_3 0.63, Al_2O_3 0.13%, and is used for chem. products. A second grade, contg. 96.06% $MgCO_3$, is used for cement; and a third grade contg. 95.85% $MgCO_3$ for refractory basic brick for furnaces. C. C. D. (*C. A.*)

Whiteware

Five thousand pieces of sanitary ware a week. ANON. *Cer. Ind.*, **3** [1], 39(1924).—(The Thos. Maddock's Sons Co., Trenton, N. J.) Domestic and imported raw mats. are used. French amorphous flint pebbles are imported and calcined in a small updraft wood fired kiln having a capacity of 18 tons of pebbles. The kiln is filled with wood and pebbles in alternate layers. The calcined pebbles are crushed in a chaser mill and dry ball milled to pass 200-mesh. Batch cars are used in weighing up the batches which are blunged in two five-ton blungers for 2 hrs. The slip is discharged into the raw agitator from which it is pumped over a double lawn of 100- and 120-mesh

respectively. After passing over the magnetic separators, the slip passes into two finished raw slip agitators from which it is pumped to the four filter presses at 110 lbs. pressure, 32 mins. being required to fill each press. The 4 presses are emptied and refilled in $1^1/_2$ hrs. After being filter pressed the clay body is either sent to the pug mills to be pugged for use in making ware by the pressing process or sent to mixing tubs to be made into casting slip. The four mixing tubs each have a capacity of 5000 lbs. of casting slip. Thirty-five tons of casting slip are prepd. daily. The salts are added in the mixing tubs. The slip is kept in storage agitators from which it is pumped to the casting rooms. A slip wt. of 32 ozs. to the pint is maintained. A total of 5000 pcs. of ware a week is produced by 91 casters and 53 pressers. Two hrs. are required to cast a piece and two casts per day are made with the same mold. The ware is dried on steam heated open floors for 10 days after which it is finished and carried on an overhead conveyor to the green room and kept at a temp. of 80°F until ready for the kiln. Grog ground to from 10- to 30-mesh constitutes 50% of the sagger body mix. The batch is aged 6 days before being pugged. A gang of 3 men make 250 stand. saggers per day on one mach. About 40 larger hand made saggers are made per man per day. The saggers average 8 fires. An elec. driven movable vertical pug mill is mounted on a track with three soaking pits for sagger batches on either side. There are 21 down draft coal fired periodic kilns each having a capacity of 400 pcs. of ware. The ware is bisque fired in saggers to cone 9 in 30 hrs. The temp. is measured with pyrometric cones. A fritted transparent lead glaze is used. The frit is fired in saggers in the bisque kiln, ground in a chaser mill and ball milled 18 hrs. with the other glaze ingredients. The glaze is sieved through a 130-mesh silk lawn and passed over a magnetic separator. The ware is dipped one day and placed in the kilns the next. The glost firing is done at cone 8 in 30 hrs. A bonus system is very instrumental in reducing the labor turnover and increasing the quality and output of the ware. P. D. H.

Some facts about ball clays. Fred S. Bell. *Cer. Ind.*, **3** [1], 27(1924).—Clays should be produced in stand. selections and not mixed at the mines. Clays from different strata but from the same deposit when fired to cone 7 vary from 0 to 9% absorption, whereas the color varies from buff, through grayish white to white. The producer should know the charact. of each stratum of clay and be reasonably familiar with the requirements of each line of ceram. product in which the clay is used. The most satisfactory way for testing ball clays is to substitute the clays in question in actual body mixts. and fire samples in different parts of the kiln in order to obtain the max. variation in temp. treatment. Inasmuch as it is difficult to obtain uniform sagger clay, the use of a certain amount of stand. ball clay is justified and thus permits the use of more tender refrac. clays. The overfiring temp. of a refrac. clay is quite as important to know as the fusion temp. A graph is shown illustrating the increase in strength of blunged clays over clays that are soaked down. Weathering is beneficial only when the entire mass of clay is kept soaked with water. P. D. H.

The properties of technical porcelains of the Royal Berlin Porcelain Factory. R. Rieke. *Z. angew. Chem.*, **37,** 190(1924); cf. *C. A.*, **18,** 157.—Detns. made during the last few yrs. may be summarized as follows, comparing Royal Berlin (*a*) with 7 other technical porcelains (*b*). Tensile strength (*a*) 320, (*b*) 161–265 kg. sq. cm.; ball-test compressive strength (*a*) 1376, (*b*) 674–1384 kg.; transverse strength (*a*) 855, (*b*) 588–777 kg. sq. cm.; impact transverse strength (*a*) 1.99, (*b*) 1.75–1.95 cm. kg. sq. cm. Ball-test compressive strength was detd. on plates 10 cm. in diam. and 1 cm. thick, between 2 steel balls of 31.7 mm. diam. Transverse strength was detd. on cylindrical pieces 16 mm. in diam. and 120 mm. long. Impact strength was detd. on a pendulum type of app. built by Schopper in Leipzig, the test pieces being 16 mm. in diam. and 12 cm. long. Soly. and appearance under the microscope are briefly discussed. C. H. K. (*C. A.*)

PATENTS

Machine for making crucibles. WILLIAM G. MOLAND. U. S. 1,497,190, June 10. In a machine for forming crucibles and the like having a bilged shape, the combination of a separable mold of fixed circumferential dimensions, a collapsible bilge shaped core mechanically associated therewith, and means for forcing a measured quantity of material into the space between the core and the mold and for thereafter compressing the same within said space to thereby form the crucible.

Machine for forming earthenware tanks. WILLIAM G. MOLAND. U. S. 1,497,191, June 10. In a machine for forming earthenware tanks, a mold, a plunger head slidably mounted therein, controllable means for applying pressure to said plunger head, a core member adapted to be supported within the mold, said core member being of such shape and dimensions with respect to the mold as to provide a space between said core member and said mold in which the tank is formed, and means for holding said core member in fixed relationship with respect to the tank during the forming operation and for thereafter withdrawing the core with respect to the mold.

Equipment and Apparatus

Practical dissertation on pebble mills. EDWARD W. LAWLOR. *Cer. Ind.*, **2** [6], 369–70(1924).—In order to eliminate iron contamination from man hole covers on ball mills, it is suggested to line the cover with a block of rubber instead of silex. This would also insure a tight fit. It costs, in material and labor, about $300 to line a 6′ x 8′ mill with silex. The inside diameter of the mill is reduced 6″. The mill is out of operation about one week. The surplus lime-carrying cement must be removed by running a while after relining. A $^5/_8$″ rubber lining (*India Rubber World*, Aug. 1, 1923, and Nov. 1, 1923) has been run in an ore mill loaded with iron balls for 9 mos. and was still in good condition, whereas a silex lining would have worn out in 6 to 8 mos. After 3 mos. service running 24 hrs. per day and after having ground at least 1000 T. of ore, no signs of wear were apparent. It would take 2 men 5 hrs. to replace an entire rubber lining. The rubber is made in man hole size strips. Rubber lining increases the capacity of the mill and reduces the cost of grinding. Any small particles of rubber passing through the sieve would be readily burned out of the ware. Irregular shaped pebbles grind better than round ones as the voids are reduced. The mill should be half full of pebbles and the charge about 23% of the total cubic capacity or 1 cu. ft. of pebbles to $^1/_2$ cu. ft. of mat. P. D. H.

Heat transfer in furnaces as caused by radiation of gases. ANON. *Fuels and Fur.*, **2**, 675–8(1924).—A presentation and discussion of mat. from *Bull.* No. 55 of the Heat Economy Bureau of the German Iron and Steel Institute (Alfred Schack), deals with heat transfer by radiation from clear gases. Diatomic gases radiate and absorb but an infinitesimal amt. of heat, while the spectra of CO_2 and H_2O vapor (both triatomic) show broad absorption (and radiation) bands, most of which lie in the infra red, or invisible portion of the spectrum. *I. e.*, products of combustion contg. CO_2 and H_2O vapor can radiate considerable quantities of heat, although they are practically non-luminous, and scarcely visible. Equations and curves are presented and tables of computations given for radiation in cal. per sq. m. per hr. of infinitely thick layers of CO_2 and H_2O vapor at different temperatures. If the gases are flame filled, incandescent particles of C float in the gas stream and increase the radiation. It is shown that low velocities of flow, and time for the gases to radiate their heat are needed at high temps., while at lower temperatures high velocities of flow are desirable, in order to increase the heat transfer by convection. A stagnant layer of products of combustion in the roof is useful because the gases absorb ht. and protect the roof from too intense a radiation. W. E. R.

Kilns, Furnaces, Fuels and Combustion

Lighting oil and gas burners. M. H. Mawhinney. *Fuels and Fur.*, **2**, 687–91 (1924).—Practical pointers on the lighting of cold fur. W. E. R.

Combustion devices for liquid fuel. W. Trinks. *Fuels and Fur.*, **2**, 21–4, 135–8, 255–8, 349–52(1924).—Describes oil burners under classification of 3 types: Vaporization, atomization and a combination of vaporization and atomization. Indus. application is limited chiefly to atomizing burners. The paper discusses methods for obtaining proper mixt. of atomized liquid fuel and air in furnaces, with conclusions summarized in tabular form:

Methd of atomization	Velocity of oil ft./sec.	Velocity of atomizing air ft./sec.	Lbs. of atomizing air per lb. of oil	Weight of momentous of oil and atomizing air	Weight of air to be induced	Velocity of resulting mixture	Pressure against which air can be induced inches of water
Mechanical oil 150 lbs. per sq. in.....	165	0	0	166	14	11	0
High press. air atomization 100 lbs./sq. in.	...	1600	1.12	1792	12.88	120	1.00[1]
Low press. air atomization 2 lbs./sq. in..	...	490	4.62	2270	9.38	151	1.70
Fan blast atomization. Air at 4 oz. pressure.....	...	139	9.50	1320	4.50	88	0.11

[1] The high pressure burner can induce against a higher pressure if more than the minimum quantity of air necessary for atomization is used. W. E. R.

Industrial heating furnaces. E. F. Collins. *Chem. Met. Eng.*, **30**, 936–41 (1924).—Lists the characteristics of elec. heat, and the different types of fur. with especial emphasis on the metallic resistor type. Photographs are given of different installations, with some performance records. M. E. M.

Metallic resistor furnaces. E. F. Collins. *Chem. Met. Eng.*, **30**, 981–5(1924).—Discusses the laws, chem., phys., and economic, governing the use of this equipment. M. E. M.

Electric furnace developments. Frank Hodson. *Iron Coal Trades Rev.*, **108**, 596(1924).—A review. J. F. B. (*C. A.*)

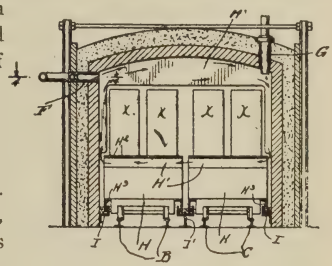
The electric furnace in the porcelain industry. Arturo Paoloni. *J. four elec.*, **33**, 70(1924).—This is a resistor furnace which can be readily maintained at the prescribed temp. (1400–1500°) for a porcelain kiln. The resistor material consists of artificial graphite (99% C). The heat reflecting walls are constructed of recrystd. carborundum. Two types of furnaces have been tried out, an intermittent type with a single chamber, and a "continuous" or tunnel type with 12 chambers in series. C. G. F. (*C. A.*)

BOOK

Trinks, W.: **Industrial Furnaces.** Vol. I. New York: John Wiley & Sons. 319 pp. 22s. 6d. (*C. A.*)

PATENT

Twin-tunnel kiln and method of operating the same. CONRAD DRESSLER. U. S. 1,499,354, July 1. The method of regulating the rate of heat transfer from the hotter ware to the colder ware in the end portion of a twin tunnel kiln, which consists in setting up a forced circulation of the kiln atmosphere in said portion of the kiln along paths looped about the kiln axis.



Geology

Pottery clay (Australia). ANON. *Bull. Imp. Inst.*, **21,** 321(1923).—White clay from Bendigo, Victoria, was tested by the Imp. Inst. 1921, on its suitability for the manuf. of porcelain and refrac. bricks: the results indicated that the clay, after washing to remove gritty matter, was suitable for the manuf. of white permeable pottery, which could be glazed to yield a fine white earthenware, and could also be used in admixt. with "grog" for production of second-grade refrac. brick. In 1922 further trials were carried out, in conjunction with felspathic and siliceous materials available for the purpose. This clay was grayish in color, plastic and practically free from grit, and superior to material examined in 1921. From the considerable differences in the compn. of this clay and previous samples, it is probable that the clay varies in different parts of the deposit. While results of these tests showed the clay to be quite suitable for manuf. of stoneware or semi-porcelain, large scale trials would be advisable to det. the working properties of the clay under indus. conditions. Mfg. operations would necessitate careful chem. control. O. P. R. O.

Bauxite (Gold coast). ANON. *Geol. Surv. Rept. of Gold Coast,* **1921.**—Further discoveries of bauxite deposits have been made in the Colony. The ore varies in quality, some of high grade while much is highly ferriferous. An interesting feature of these bauxite deposits is that in some cases they carry both gold and silver in appreciable quantities. It is suggested in the Rept. that the gold and silver might be worth recovery from the insol. residues which would result from the treatment of the bauxite by the Bayre process. O. P. R. O.

Bauxite (India). K. P. SINOR. *Bull.* **3** (1923) (Geol. Dept. of Rewa Ste).—Bauxite of high grade is found in large quantities on the Amarkantak plateau, and in the hills north of Nerbudda River. Sinor describes these deposits with special reference to the possibilities of establishing an aluminium-producing industry in the State. Picked specimens of this bauxite contained from 62 to 66% of alumina, the general quality ranging from 51 to 57%. Bauxite of lower grade occurs in large quantities at many places in the Ste. O. P. R. O.

Mineral pigments (Australia). ANON. *Bull. Imp. Inst.*, **20,** 244(1922).—Valuable deposits of oxides and ochers have been found, principally in the neighborhood of Cape Flattery. Samples of quartz sand-washed from these pigment deposits in the course of refining have been investigated at the Imp. Inst., and found to be suitable for the manuf. of glass, for such purposes as the production of pale-tinted bottles. (*Chem. Trade Jour.*, 694(1921).) O. P. R. O.

Fluorspar deposits of Kentucky. LOUIS W. CURRIER. *Ky. Geol. Surv.*, **13,** 6(1923).—Describes the origin, occurrence, association, mining, milling and uses of Kentucky fluorspar. C. E. B.

Chemistry and Physics

Borax from colemanite. BURTON G. WOOD. *Chem. Met. Eng.*, **30,** 976–8(1924).—The process by which borax is obtained from colemanite is described in detail. M. E. M.

Viscosity. The British Engineering Standards Association (28 Victoria St., London, S. W. 1) has issued Publication No. 188—1923 "British Standard Method for Determination of Viscosity in Absolute Units." H. H. S.

BOOK

FREUNDLICH, DR. HERBERT: **Kapillarchemie: Eine Darstellung der Chemie der Kolloide und Verwandter Gebete.** Third edition pp. xvi — 1225. Leipzig: Akademische Verlags-ges., 1923.—Deals with colloid chem. in relation to surface tension, adsorption, electrical surface effects, kinetics of new phases, Brownian movement, sols (lyophobe and lyophile), gels, clouds, smokes, and systems in which the continuous phase is solid. H. H. S.

Preparation of alumina from metallic nitrates. ANON. *Oil and Color Trade Jour.*, **65,** 1744(1924); (Ger. 339,983, Goldschmidt, Christiania).—Aluminium and other nitrates are partially decomposed by ht., so as to form a mixt. of hydrated alumina and undecomposed nitrates of the other metals, the latter being removed by lixiviation. The nitrous fumes evolved are converted into nitric acid, which is utilized for the dissociation of fresh quantities of the raw materials. The recovered nitrates of lime, potash, soda, etc., can be worked up into a mixed fertilizer, or treated for the sepn. of the constituent nitrates or the production of nitric acid by known methods. O. P. R. O.

Geology

Some methods for heavy mineral investigations. R. D. REED. *Econ. Geol.*, **19** [4], 320–37(1924).—The paper discusses methods adapted to correlations by the study of heavy mineral residues. C. W. O.

Manufacture of potash and other salts from leucite. J. W. HINCHLEY. *J. Soc. Chem. Ind.*, **43,** 158–69(1924).—The fact that the whole of the world's supply of potash is still obtained from practically one district is a matter of concern to other nations. The most hopeful source of supply is in the minerals of igneous rocks, and of these leucite, which occurs along the line of the Italian volcanoes, is the most attractive. Leucite, $K_2O.Al_2O_3.4SiO_2$ in a state of purity contains 21.5% K_2O, 23.5% Al_2O_3, 55.0% SiO_2. The natural mineral contains less potash through replacement by MgO and Na_2O, but in some places, notably Rocca Monfina, fine leucite occurs in large quantities, computed by H. S. Washington to contain 1008 metric T. of K_2O. Voelcker finds that powdered leucite has the same manure value as soluble manures of the same potash content. The Rocca Monfina industry is being developed by Baron Blanc, who found that if acid be continually circulated through grandular leucite a soln. was obtained in which no gelatinous silica occurred to make the sepn. of liquid and solid difficult. With sulphuric acid, potash alum is formed, and the residual silica is added to caustic to form sodium silicate. The yield of alum and sod. silicate is 80%. As the market for alum is not large, Blanc also treats leucite with HCl which presents greater chem. engineering difficulties on account of the volatility and greater corrosive action of HCl. The plant must be completely closed, with a vent connected to a scrubbing tower for removal of fumes. The product KCl and Al_2Cl_6 are passed into a cooling app. where KCl crystallizes out. The liquor is treated with HCl gas and hydrated aluminum chloride crystals are pptd. These heated to 280°C yield al. hydroxide and HCl. The yield is 93%. One T. of leucite requires 618.3 kg. of HCl gas or 197.6 kg. of H_2SO_3. Taking factory operations, handling 36 T. of leucite per day, 5 T. of HCl would be required. The cost of fuel would be $0.70 per T. of leucite treated, and the products would amt. to $10^1/_4$ T. KCl, 8 T. alumina, and 9 T. silica. Other processes than Blanc's are: Haege's process for making a phospho-potash fertilizer, an acid process using HNO_3, an elec. fur. process for pot. carb. and alumina, and an autoclave process for producing caustic potash from leucite and lime; the last two due to Jourdain. H. H. S.

Systematizing combustion practice for educational purposes. C. BLACHER-RIGA. *Feuerungstechnik*, **12** [11], 81(1924).—Tabulates for comparative purposes the principle characteristics accompanied by simple line sketches of (1) Boiler fur., (2) Gas generators. These tables cover in a very compact and comprehensive way the various methods used in practice and show clearly the general principles involved. F. A. W.

Measurement of the surface tension of glass. AD. LECRENIER. *Bull. soc. chim. Belg.*, **33**, 119–22(1924).—The drop wt. method was used, results being calcd. from Glugialmo's formula $\alpha = (p/2\pi r)(1 + r/R)$, where α is the surface tension in mg./mm., p the wt. of the drop in mg., r the radius of the dropping orifice in mm., R the radius of curvature of the tip of the drop. The app. consisted of a Pt crucible with an orifice in its bottom (r = 1.928 mm.) suspended in a vertical tubular elec. fur., a thermocouple being placed near the dropping tip. To det. p a large number of drops were collected by dropping into hot oil. R was detd. by permitting a drop to form but removing the crucible vertically from the fur. just before the drop fell, the drop being obtained suspended by a long glass thread; thus no distortion of the tip was introduced. A number of observations were made at each temp., the max. deviation being approx. 6%. For an ordinary soda glass the values of α were 41.58 (1025°), 41.42 (1125°), and 41.23 (1225°), while flint glass gave 39.66 (1025°), 39.16 (1125°), and 38.97 (1225°).

W. B. P. (*C. A.*)

Specific heats of products of combustion from gas furnaces. L. E. BIEMILLER. *Gas Age-Record*, **53**, 423–4(1924).—The sp. heats of CO_2, SO_2, H_2O vapor, N_2, O_2, and CO are recalcd. from the data of Lewis and Randall (*C. A.*, **6**, 3353) into units of B. t. u. per cu. ft. (at 60°F and 30 in. Hg) per °F for the temp. interval 60°F to t°F to make them directly applicable to industrial gas calcns. Curves are given.

H. G. B. (*C. A.*)

Production of pure alumina from clay. HARALD PEDERSEN. *Tids. kemi Bergvesen*, **3**, 161–4, 175–8(1923); **4**, 11–7(1924); *Teknisk Ukeblad*, **42**, 75–7, 83–6(1924).—A full report of a radically new process for the production of Al_2O_3 for Al manuf. The raw material was a common Norwegian clay contg. Al_2O_3 16%, Fe_2O_3 8%, CaO 2%, MgO 1%, Na_2O 2.5%, K_2O 3.5%, and SiO_2 55%. As mined it contained 30% H_2O but was easily air-dried to 5–10% H_2O. A usable clay should contain not more than 4% of CaO and as much Al_2O_3 and K_2O as possible. The air-dried clay is kneaded and mixed with cold H_2SO_4 (chamber-acid). An excess of clay is best used to obtain a high yield of the acid and a better decompn. of the compds. of K_2O and Al_2O_3 than of the Fe compds. To 1 ton of clay 1.2 ton of the acid was theoretically required, whereas 0.7 ton was found to give the best economy. The reaction mixt. was allowed to remain quiet for 12 hrs. and then was heated to 150–200°. The SiO_2 is thus converted to an amorphous, easily filterable state and part of the $FeSO_4$ is converted to basic ferric sulfate, the liberated H_2SO_4 attacking the excess clay and forming additional amts. of Al and K sulfates. The mass was then leached counter-currently, the temp. being kept at about 80°. At this point considerable amts. of Fe are sepd. as basic ferric sulfate and an extra amt. of Al and K is dissolved from the excess of clay. The resulting residue contained 8% of total H_2SO_4 calcd. to dryness. The liquor had a sp. gr. of about 1.35 and contained 80 g. Al_2O_3 and 20 g. K_2O per l. The Fe content was about 16% of the Al_2O_3, whereas in the original clay the ratio was about 40–100%. The liquor was cooled to 15° whereby $^1/_3$ of the Al_2O_3 was pptd. as K alum. The rest of Al_2O_3 was pptd. by addn. of solid K_2SO_4 under agitation at a relatively low temp. From 1 cu. m. liquor 700 kg. of raw alum with 0.1% Fe was obtained. This salt was dissolved in hot water and recrystd., yielding an alum with only 0.005–6% Fe. The water of crystn. was removed by heating in a rotary drum with producer gas. Drying in Fe pans was not successful owing to the viscosity and low heat condy. of the fused salt and its action on the iron. No

H_2SO_4 was expelled during the drying. The decompn. of the alum offered great technical difficulties, and was finally accomplished by heating directly with producer gas in a vertical shaft furnace charged at the top and discharged at the bottom. The gases contained 8 vol. % of SO_2. The decompn. product corresponded very closely to the formula $Al_2O_3.K_2SO_4$. It was leached hot with a soln. of K_2SO_4 satd. cold, the dissolved K_2SO_4 being pptd. by cooling. Per ton of Al_2O_3 produced something over 400 kg. of very pure K_2SO_4 was obtained. The residual Al_2O_3 from the filters contained about 50% H_2O which was easily removed by heating to 400–500°. The consumptions of coal and H_2SO_4 per ton pure Al_2O_3 were as follows: Heating the reaction mass 375 kg., drying the alum 800 kg., decompn. of the alum 600 kg., drying the oxide 200 kg., heating various liquids 316 kg., total 2.291 kg. Loss of H_2SO_4 by decompn. 36 kg., in the clay residue 1260 kg., in the alum 3221 kg., in the mother liquor 516 kg., total 5033 kg.; recovered by decompn. of the alum and absorption 2,855 kg., resulting net consumption 2,178 kg. When the market value of the recovered K_2SO_4 is taken into account a smaller net cost per ton of Al_2O_3 produced from clay by this procedure is obtained, compared with Al_2O_3 produced from bauxite by the Bayer process. The use of *labradorite* was tried in this process, but although the Al content of this material (about 30%) is much higher than in clay the latter is more favorable, owing to the valuable K_2O content. Labradorite contains no K_2O but much H_2SO_4-consuming CaO.

C. H. A. S. (*C. A.*)

General

Spontaneous combustion of coal. J. I. Graham. *J. Soc. Chem. Ind.*, **43**, 79T–87T(1924).—Two theories regarding spont. combustion have been held, one that it is due to pyrites (FeS_2) oxidizing to $FeSO_4$; the other that it is the result of oxidation at ordinary temp. of org. subs. in coal. The pyrites theory does not explain all cases nor is a high rate of oxidn. of coal the only factor. A most important property is that of friability, the prodn. of fine dust being a necessary factor. With regard to the constituents of coal, G.'s result on oxidn. of durain, clarain, and vitrain, agree with those of Wheeler and Tideswell, but differ markedly in respect to fusain. G. finds that fusain from different sources shows very slight absorpn. and similar results have been found more recently by T. and W.

H. H. S.

BOOK

Dunn, J. T., D.Sc.: **Pulverised and Colloidal Fuel.** Pp. 197. London: E. Benn, Ltd. 1924. Price, 25s.

H. H. S.

BOOK REVIEW

A Preliminary Report of the Clays of Florida (Exclusive of Fullers' Earth). By Olin G. Bell, 1924. 207 pages. From the Fifteenth Annual Report of the Florida State Geological Survey, Tallahassee, Florida.

This report considers only the known clay deposits within reach of transportation and without excessive overburden. The general geology, classification, mineralogy, chemical and physical properties, and uses of the clays are briefly discussed. Complete footnote references are made to other writers. The clays were tested by Mr. Bell in the clay testing laboratory of Dr. H. Ries at Cornell University.

The contents of the report are briefly reviewed by chapters.

Chapter I. General Geology of Clays. The term clay is defined, and the origin of clays and the various geologic types of clay deposits are given.

Chapter II. Classification of Clays. The classification of Ries is given based primarily on the geological occurrence and secondarily on the firing qualities of clays.

The classification of Grout and Soper is given based on physical properties with refractoriness as the basis of subdivision. Reference is made to Parmelee's classification which is based on the uses of clays according to their physical properties.

Chapter III. Mineralogy and Chemical Properties of Clays. The various minerals found in unfired clays are noted together with the abundance, physical properties and pyrochemical behavior of the respective minerals. The minerals found in fired clays are discussed briefly. The relative merits of ultimate versus rational chemical analysis are given. Included is the information obtainable from an ultimate chemical analysis as listed by Ries. The chemical effect of the various constituents in clays on the firing behavior of the clay is also given.

Chapter IV.—Physical Properties of Clays.—The more important physical properties are treated. The nature of the vitrification process, as discussed by Orton, is given. The Seger cone numbers, as commonly used for guidance in the firing of the different classes of ware listed, are indicated in a table. A chart is also given showing the important firing range temperatures of various clay products.

Chapter V.—Tests Made Upon Clays.—The methods used in the determination of the physical properties, both in the unfired and fired state, are given.

Chapter VI.—Kinds of Clays and Their Uses.—The physical properties of the different kinds of clays are noted together with their chief use. The uses of raw and fired clay as listed by Ries are also given.

Chapter VII.—Geology of the Clays of Florida.—The stratigraphy of the geologic formations in Florida is thoroughly covered in a table. The physical nature, location, extent and thickness of the various formations are noted together with the geologic age, occurrence and distribution of the clays. The conditions of sedimentation and sources of material are also discussed.

Chapter VIII.—Distribution and Description of Deposits by Counties.—The various clay deposits are described with reference to their extent, properties and uses. The more important physical properties of the unfired clays and of the clays fired to different temperatures have been determined and the results listed. The various uses to which each clay is suited are also given. A number of views of plants and clay pits are shown. A map of Florida shows the location of ceramic plants, kaolin mines, Fuller's earth mines, points where common clays were tested and sedimentary kaolin occurrences.

Chapter IX.—Sedimentary Kaolin.—The terminology of the clay is discussed and its general distribution given. The deposits are described and their geologic age discussed. Various theories are given for their origin. The history of their development is noted together with their uses, the names of companies working the deposits and the methods of mining employed. Samples from the different producers were tested and the results obtained on the unfired specimens, as well as on those fired to different temperatures are noted. Results of chemical and mineralogical analyses are given. Distribution of the deposits is given by counties. Some plant views are shown.

Chapter X.—Development and Possibilities of the Clay Industry in Florida.—A history of the development of the industry is given and the present status described. The future possibilities based on the local potential demand are noted.

Chapter XI.—Methods of Prospecting for Clays.—A procedure is recommended for making the preliminary tests and for determining the extent and uniformity of the deposit.

Appendix A.—Statistics of Production of Brick (1899 to 1922).

Appendix B.—Fusion Points of Seger Cones (including chemical composition).

Appendix C.—Directory of Florida Clay Workers (exclusive of Fuller's earth).

Appendix D.—Bibliography of Florida Clays.

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PERRY D. HELSER

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CERAMIC ABSTRACTS

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Abrasives

PATENT

Sectional grinding wheel. Frank J. Tone. U. S. 1,502,697, July 29, 1924. A grinding wheel including a supporting drum, segmental blocks of grinding material arranged in a plurality of circumferential rows, and means common to adjacent rows and extending circumferentially of the drum for retaining the segments thereon.

Cement, Lime and Plaster

Action of gypsum on the setting and hardening of cement. Friedrich Tippmann. *Zement*, **13**, 135–6, 147–50(1924).—During a 12-mo. period T. observed the rate of crystn. and gel formation of various clinkers immersed in distd. H_2O and in $Ca(OH)_2$ soln. Crystals visible under low magnification developed in the solns. of SO_3-free clinkers in 1 day, while those contg. 5% gypsum showed crystals after 8 days, with definite gel formation. The SO_3-free cements had no tendency to swell. The action of gypsum is to retard the crystn. and to promote colloid growth. The flash set is due to crystn. the later set and hardness to colloid action. H. F. K. (*C. A.*)

Enamels

Heat-transference in enamel-lined apparatus. E. P. Poste. *Ind. Eng. Chem.*, **16**, 469–70(1924); *J. S. C. I.*, **43B**, 541(1924). H. H. S.

Enameled apparatus from a chemical engineering standpoint. E. P. Poste and Max Donauer. *Ind. Eng. Chem.*, **15**, 469–71(1923).—Enameled app. is finding increased use in chem. processes. The enameler must produce an enamel that will meet its special requirement fully. As the severity of acid corrosion becomes greater it is necessary to limit the size and shape of the vessel to insure a perfect enamel coating. W. H. B. (*C. A.*)

Enamel-lined apparatus. E. G. Miner. *Chem. Met. Eng.*, **28**, 687(1923).—Enameled steel tanks will withstand very high pressures as well as possess non-corrosive and acid-resisting properties. Coördinated efforts have resulted in standardization of units, as follows: a standard jacketed still with reducing ell, for the distn. of essential oils and acids, the reduction of fats, etc., a standard jacketed closed mixing tank with enameled steel agitator, an open evapg. or crystg. pan, a standard utility pot, and special equipment. W. H. B. (*C. A.*)

PATENTS

Enameling process. Henry Moecker, Jr. U. S. 1,503,991, Aug. 5, 1924. In an enameling process, the steps of applying to the article prior to the application

of the enamel, wet patterns, then applying the enamel to the article and allowing it to dry, and then removing the dry patterns to effect a removal of the enamel from the article in the desired places prior to the fusing of the enamel.

Enamel opacifying composition and process of making the same. HUGH SPENCER COOPER. U. S. 1,502,421, July 22, 1924. Process of treating naturally occurring zirconium silicate to produce an enamel opacifier, which comprises wet-milling the material to a condition of extreme fineness, treating the milled material with an acid and then washing, drying, and strongly igniting the material.

Zirconium containing composition and process of making the same. HUGH S. COOPER. U. S. 1,502,422, July 22, 1924. Process of treating zirconium silicate, which comprises wet-milling the silicate to a condition of extreme fineness, reacting upon the milled material with concentrated sulphuric acid, and removing residual acid and substances rendered soluble thereby.

Insulating enamel on wires, etc. L. DE RAPHELIS-SOISSAN. U. S. 1,495,632, May 27. Wire or the like to be coated with insulating enamel is first given a ground stratum of a flexible porous substance, *e. g.*, asbestos, powd. enamel is applied to this, shaped and heated to the m. p. to produce an overlying enamel coating. (*C. A.*)

Glass

Basic glass. A. BIGOT. Meeting (May 2) of Soc. de Chem. Industrielle. *J. Soc. Chem. Ind.*, **43,** 513–4(1924).—City refuse can be profitably treated by incinerating the non-fertilizing portion under boilers for electrical generation, and fusing the residues with fluxes to make glass for bottles, insulators, and the like. H. H. S.

Hydration of natural and artificial glasses. G. SCHOTT AND G. LINCK. *Kolloid-Z.*, **34,** 113–6(1924); *J. S. C. I.*, **43B,** 422(1924). H. H. S.

Effects produced by chilling glass. A. Q. TOOL AND C. G. EICHLIN. *J. Opt. Soc. Amer.*, **8,** 419–49(1924); *J. S. C. I.*, **43B,** 468(1924). H. H. S.

Noteworthy productions of the glass craftsman's art. I. The reproduction of the Portland vase. JOHN NORTHWOOD. *Jour. Soc. Glass Tech.*, **8** [30], 85(1924).—A brief history of the original Portland vase, and a description of probable methods of manuf. The successful reproduction of the vase in glass by John Northwood and Philip Pargeter, the artist is described. J. G. P.

Noteworthy productions of the glass craftsman's art. II. Mr. John Northwood's Plaque of Aphrodite. W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **8** [30], 92(1924).—A description of the Cameo Glass Plaque, completed by John Northwood in 1906, and of methods used in the production. J. G. P.

The thermal endurance of glass. I. VAUGHAN H. STOTT. *Jour. Soc. Glass Tech.*, **8** [30], 139(1924).—A formula is derived which dets. the time which elapses before rupture occurs after a given change in temp. Exptl. data are given. In conclusion it would seem that while, from the point of view of thermal endurance, a suitable glass for a specific purpose can be selected from a knowledge of its phys. properties, it is more difficult to det. the best methods of making any actual article, or to arrive at a proper method of testing its suitability when made. It does not appear desirable at the present stage to standardize any specific method of testing for thermal endurance, in view of the doubt which exists how far the results of any such test which can be readily applied may correspond with the service behavior of the product tested. J. G. P.

The use of pyrometers in the glass industry. E. A. COAD-PRYOR. *Jour. Soc. Glass Tech.*, **8** [30], 94(1924).—The value of pyrometric equipment in a glass factory depends essentially on three factors, namely, on (1) the trustworthiness of the pyrometer itself, particularly the clockwork, (2) the skill which is expended on its maintenance and (3) the attitude with which the management, foreman and fur. operators regard

it. The value of the pyrometer for the various operations in glass manuf. is pointed out, the different types of pyrometers are taken up, and the relative merits of each type for the different operations are discussed. J. G. P.

Continuous high temperature measurement in glass works. WILLIAM M. CLARK. *Jour. Soc. Glass Tech.*, **8** [30], 105(1924).—A résumé of the advantages derived from the use of pyrometric equipment, with suggestions as to their use for continuous high temp. measurement. J. G. P.

Practical applications of pyrometers to glass works. C. E. FOSTER. *Jour. Soc. Glass Tech.*, **8** [30], 109(1924).—Thermocouple pyrometers, pyrometers for measg. high temps., optical pyrometers, total radiation pyrometers are taken up and discussed. The proper use of pyrometers described, and the practicability of pyrometric practice in glass works is pointed out. J. G. P.

Some reflections on pyrometer design and a description of a new radiation pyrometer. W. BOWEN. *Jour. Soc. Glass Tech.*, **8** [30] 117(1924).—In the practical application of pyrometry the pyrometer should be simple of design and operation, robust, or free from liability to breakdown under shock or accident, flexible to meet practical conditions, durable, have a speedy response to temp. changes, be free from dependent conditions such as distance, or personal error, and should be accurate. A new radiation pyrometer has been devised. The principle of operation depends on the Stephan-Boltzmann Law of Radiation. The instrument has a lens in place of the usual mirror reflector, to concentrate the radiation on to a thermocouple situated at its focus. The heat so concd. develops an electromotive force which is transmitted to the millivoltmeter, the scale of the latter being calibrated in temp. degrees in the usual way. An eyepiece is fitted to the face of the instrument, to assist the operator in centering the field of vision on the hot body. All these parts are fitted in a casing, so as to form one single unit, of extreme portability and compactness. The pyrometer is applied like a telescope. The time required to take a reading is between 2 and 3 seconds. The distance factor is approx. 24 to 30 and can be increased to as high as 40. J. G. P.

The cause of color produced in glasses of anhydrous borax and $NaPO_3$ by fusion with metallic oxides. T. COHN. *Chem. News*, **129**, 32(1924).—A color chart using $NaPO_3$ and borax is given with the change on increasing the concn. of the oxides of Co, Ni, Cu. Protracted htg. was tried to see if a change in color could be brought about. The beads were dissolved to see if the color was due to colloidal suspensions and found to be metallic salts. The conclusion arrived at was that the beads of Cu, Ni, Co, in borax and $NaPO_3$ were due to colored metallic salts and that Ag, Pt, and Au give colloidal suspensions. S. S. C.

Industrial pyrex. A. E. MARSHALL. *Chem. Met. Eng.*, **28**, 690–2(1923).—Desirable qualities of plant construction materials include: resistance to chem. corrosion, heat and temp. changes, a reasonable degree of mech. strength, possibility of production in a variety of shapes and a cost within com. possibility. Pyrex possesses many desirable phys. and chem. characteristics, but with limits as to size or requiring the development of new types of construction based on available shapes. It is industrially applicable: where acid resistance is important; where resistance to heat shock is desirable; where purity of product is essential; and transparency is involved. Applications to each class are mentioned. W. H. B. (*C. A.*)

Estimation and removal of iron in glass-making sands. L. SPRINGER. *J. Soc. Glass Tech.*, **7**, 234.—Previous attempts to reduce the amt. of Fe in sands had not met with much success. The Badische Anilin- und Sodafabrik, Ludwigshafen, had recently described a process as follows: "Washed sand without drying is covered with twice its weight of water, and 1% of concd. H_2SO_4 added and well mixed in. Then 1% of '*Blankit*' (which is essentially a reducing agent) is added and thoroughly mixed

in. In 5 or 10 min. the liquid becomes turbid and is run off. The sand is then washed with water 2 or 3 times and dried." Samples of Hohenbocka sand after treatment were whiter. By ignition, it turned to a weak yellow tint contrasted with the strong reddish yellow of the ignited but untreated sand. Expts. on a Saxon grey sand failed to improve its color. Analyses showed before and after purification, resp.: Saxon sand, Fe_2O_3 0.050, 0.040%; Hohenbocka sand, Fe_2O_3 0.040, 0.032%. According to S., only the iron coating of the sand grains was removed by the Blankit or by treatment with HCl. This was of little use for the glass industry, but of more use for clay-working industries. Expts. were then made to ascertain if calcination would materially improve the Saxon sand. An unwashed sample, ignited at 1200° and analyzed in a Bohemian glass technological lab., showed only 0.02% of Fe_2O_3. S. then carried out numerous expts. to verify or refute this apparently remarkable result. In particular, it was desired to find out whether a Grade II sand contg. more than 0.03% of Fe_2O_3 and suitable for making ordinary white glass could be converted by calcination to a Grade I sand contg. less than 0.03% of Fe_2O_3. As a check on S.'s analysis, sands were sent for analysis to other labs. specializing in silicate analyses. Conflicting results were obtained. Some results indicated that the iron content of a sand was reduced by calcination, and, moreover, that the loss was increased by increasing the ignition temp. Some indicated that no appreciable good resulted. Finally, the Saxon sands calcined on a fairly large scale in a window glass glory hole at 1000° for 5 hrs. were used in a series of melting and decolorizing expts. in a crystal glass furnace, but the results were unsatisfactory. H. G. (*C. A.*)

A new shock- and heat-resisting glass. J. Wolf. *J. Soc. Glass Tech.*, **7**, 240–1.—The new glass, claimed by its inventor, Dr. Horak, to be unbreakable, and recently produced commercially in the form of app. and cooking vessels under the description "Resista" glass, has the percentage compn.: SiO_2 78.94, B_2O_3 13.50, Na_2O 2.78, K_2O 1.93, MgO 0.97, Al_2O_3 0.93, CaO 0.28, Fe_2O_3 0.47, TiO_2 0.07. In essentials, therefore, it differed but little from the well known Pyrex glass, having nearly 2% less SiO_2 and about 2% more B_2O_3, and having also a small amt. of MgO. As one of the specimen cooking vessels broke in use almost immediately after purchase, the glass was not unbreakable, although other specimens showed it to be resistant. Three batches were suggested for the prepn. of the glass, namely: Hohenbocka sand 100, Bohemian feldspar 8, magnesite 3, KNO_3 5, cryst. borax 20, cryst. boric acid 20; Salesel kaolin sand 100, phonolite from Bileri 13.5, dolomite 1.3, cryst. borax 22.0, cryst. boric acid 13.3; sand 100, KNO_3 4.75, marble 0.40, magnesite 2.75, cryst. borax 14.80, cryst. boric acid 18.4, phonolite 60. H. G. (*C. A.*)

The density of glass and the process of melting. H. Schall. *J. Soc. Glass Tech.*, **7**, 242.—The decrease in the d. of molten glass with increase of temp. would appear to prevent circulation and so to retard melting. Actually circulation did occur. This was due to the escape of gas bubbles from the top layer of glass, which accordingly became denser and sank. Batch usually floated, but when filled into a very hot pot contg. only a little molten glass it sometimes sank and adhered to the base of the pot, subsequently becoming detached and causing batchy metal. To prevent this, a ladle of cullet should first be filled on. H. G. (*C. A.*)

The electrical conductivity and transition points of glasses. Herbert Schönborn. *Z. Physik*, **22**, 305–16(1924).—The equation of Hinrichsen and Rasch (*C. A.*, **5**, 30): $\log W = (\nu/T) + C$, where W is the resistance, T abs. temp. and ν and C are consts., holds for glass through its m. p., abrupt changes in the slope of the curve of $\log W$ against $1/T$ being interpreted as transition points in the region of the "crit. zone" for thermal expansion. D. C. B. (*C. A.*)

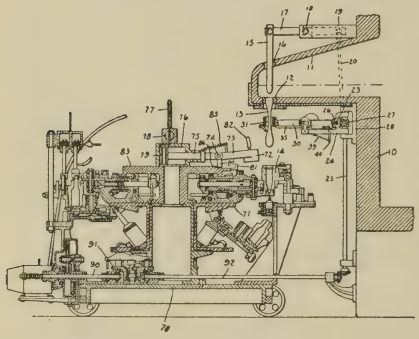
The use of filter plates made from sintered glass. P. H. Prausnitz. *Chem.-Ztg.*,

48, 109–10(1924).—A description of Schott & Gen. (Jena) sintered glass filter plates and their uses. The plates are made by sintering together pulverized glass particles of definite size; they can be melted into any kind of vessel made of the same Jena glass, thus dispensing with the prepn. of filtering mediums like asbestos fiber, shredded filter paper, Gooch crucibles and similar devices. The plates are made in sizes 10–120 mm. Examples of their use in analytical chemistry, chem. prepns. and electrochemistry are offered. W. C. E. (*C. A.*)

Quartz ware and quartz glass. Z. V. HIRSCHBERG. *Z. angew. Chem.*, **37,** 99–100 (1924).—A review. G. E. B. (*C. A.*)

The "Spiegel" group of glasses. E. ZSCHIMMER. *J. Soc. Glass Tech.*, **7,** 163–4.—To find the relationship between the compn. and the chem. stability of glasses of the so-called "Spiegel" group (that is, soda-potash-lime-silica glasses), Z. studied 249 com. glasses of which the compns. had been published by various workers and the stabilities observed either quantitatively or qualitatively. The method used was to mark the compns. of the glasses on a 4-dimensional diagram, and at the points obtained to indicate the relative stabilities. By this means approx. boundaries could be marked. The glasses were divided into 3 groups, (1) resistant (approximating to Class II of Mylius), (2) medium (Class III), and (3) bad; and the following useful rules were deduced: All glasses in the first 2 groups had a lime content lying between 7.5 and 15%. Resistant glasses had a total alkali not exceeding 13%. Medium glasses were those with a total alkali content from 13 to 19%. H. G. (*C. A.*)

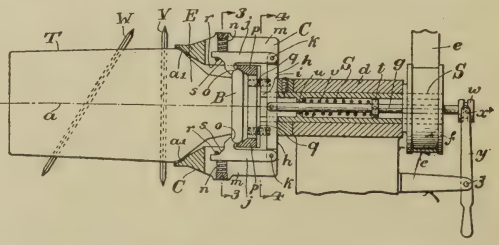
Critical discussion of a glass furnace. R. W. MULLER. *J. Soc. Glass Tech.*, **7,** 197.—A description of a 14-pot furnace which did not come up to expectations. E. J. C. (*C. A.*)



PATENTS

Glass-feeding mechanism. EDWARD MILLER. U. S. 1,500,879, July 8, 1924. In app. of the kind described, a glass tank spout with a discharge opening in the bottom thereof, a shear arm mounted below the spout and having an opening through it registering with the opening in the spout, a knife reciprocably mounted on said shear arm for severing the glass, and means for lowering the shear arm as the glass descends from the spout and for elevating the shear arm after the glass has been severed.

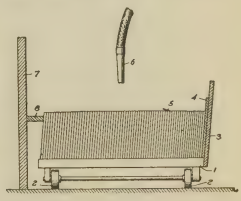
Method of producing glassware. JOHN A. MILLIKEN. U. S. 1,503,962. Aug. 5, 1924. The method of producing an article of glass, which consists in forming said article with an integral extension provided with a shoulder portion, exerting tension on said extension in a direction longitudinally thereof for holding said shoulder portion against an abutment, decorating said article by grinding while so held, and thereafter while rotating severing said article from said extension.



Machine for making bottles, etc. WARREN E. GLASPEY. U. S. 1,502,560, July 22, 1924. In a machine of the character set forth, the combination of a mold-carrier,

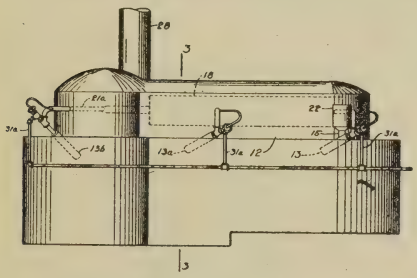
a series of molds carried thereby, nuts carried with said molds, threaded mandrels working through said nuts, frictionally held gears mounted on the lower ends of the mandrels, yieldingly mounted racks disposed on opposite sides of the path of said gears, one of said racks being adapted to turn the gears in a direction to elevate the mandrels and the other of said racks being adapted to turn the gears in the direction to lower the mandrels, and stops serving to limit the raising and lowering of the mandrels.

Machine for making bottles, etc. WARREN E. GLASPEY. U. S. 1,502,561, July 22, 1924. In a machine of the character set forth, the combination of a mold-carrier, a series of molds carried thereby, a non-rotating mandrel associated with each mold and equipped with a sheathable lug-forming member, and means for raising and lowering the mandrels.

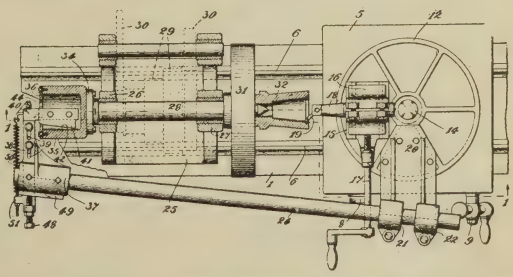


Process of finishing the edges of glass sheets. AUSTIN C. HILEMAN. U. S. 1,503,586, Aug. 5, 1924. The process of finishing the edges of glass sheets which consists in placing a series of the plates side by side with their adjacent side surfaces in opposition and close together and with the edges to be treated in substantial alignment, and then applying a sand blast to the said edges.

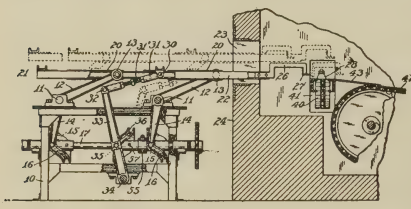
Glass-making apparatus. WILLIAM R. SMITH. U. S. 1,500,651, July 8, 1924. A glass-making app. comprising a closed tank formed to confine a body of molten glass, an elongated tubular melting twyer extending through the wall of the tank, the inner end of the twyer constituting a burner located within the tank above the bottom thereof, means for admitting gas and air under pressure to the outer end portion of the twyer, and means for delivering glass materials to the flame resulting from combustion at said burner, so that said materials may be projected into the tank, melted by the burner flame and accumulated in a molten condition in the tank below said burner.



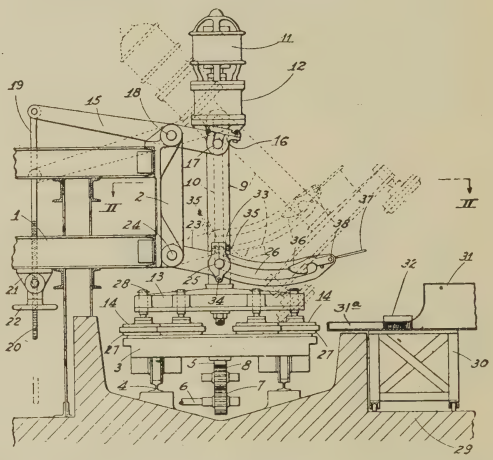
Device for making fluted glass molds or the like. PETER KUCERA. U. S. 1,502,474, July 22, 1924. A device for manufacturing fluted molds for glass machines and the like comprising a main shaft, means for mounting a mold body on said main shaft, a pattern member also mounted on said main shaft, a turntable, a forming tool mounted on said turntable and adapted to operate upon said mold body, and an actuating device coöperating with said pattern to oscillate said turntable and said tool to produce a predetermined configuration on said mold. A device of the character described comprising a main shaft, work supporting means on one end of said main shaft, a pattern member on the other end of said main shaft, a forming tool adapted for rotation relatively to said main shaft, means to feed said tool longitudinally of the work, an actuating device carrying the templet and being adapted to oscillate said tool to cause same to follow a predetermined path, a templet adapted to engage said pattern, and stop means adapted to determine when said oscillation shall begin relatively to the feed of the tool.



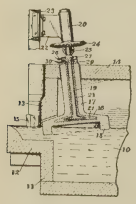
Leer feeder. MINOT K. HOLMES. U. S. 1,501,602, July 15, 1924. A leer feeder comprising a main frame, a pair of rock shafts journaled on said main frame, a pair of arms carried by each rock shaft, each of said arms being provided with a push frame support, a push frame slidably mounted upon said push frame supports, a main drive shaft, cam mechanism on said shaft, connections between part of said cam mechanism and the rock shafts and connections between another part of said cam mechanism and the push frame whereby rotation of the shaft will produce vertical and horizontal reciprocations of the push frame, and means for relatively adjusting the cam mechanism to adjust the push frame vertically.



Apparatus for surfacing plate glass. JOHN H. FOX. U. S. 1,501,327, July 15, 1924. In combination in a glass surfacing machine, a framework, a surfacing unit mounted for vertical movement with respect to the framework and for lateral swinging movement about its upper end, and comprising an upright supporting member, a vertical shaft journaled therein, and a runner secured to the lower end of the shaft, driving means for the shaft, releasable means for holding the lower end of said unit against lateral movement, means for carrying the glass to be surfaced laterally beneath the runner, and means for holding the unit in inclined position after said last means are released and the lower end of the unit swung laterally.



Process for making glass-mold plungers. JACOB SODERBERG. U. S. 1,501,246, July 15, 1924. A process for making plungers for glass molds for producing lenses having superimposed annular and transverse surfaces, which consists in forming the plunger of a base plate and a plurality of transverse strips substantially rectangular in cross-section by assembling and securing the strips side by side to the base plate to provide a composite plate, machining the front face of such composite plate to provide a series of annular prisms upon the face of the plate, and then removing the strips from the base plate, securing them upon a second base plate surfaced to tilt the strips from the positions occupied in their preceding positions and give them the various inclinations desired for the formation of said transverse surfaces.

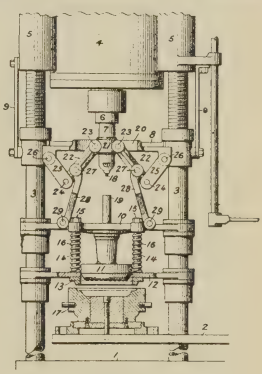


Glass-circulating mechanism. LEONARD D. SOUBIER. U. S. 1,502,068, July 22, 1924. The combination of a tank to contain molten glass, said tank comprising a main portion and a forehearth projecting beyond a wall of the tank to expose a surface of the glass, a glass circulating device within said main portion of the tank behind said wall, and means to actuate said device and thereby maintain a continuous circulation of the glass forming said surface.

Annealing leer for plate glass. H. WADE. Brit. 212,997, Dec. 21, 1922. (*C. A.*)

Drawing sheet glass. E. ROWART. Brit. 212,545, March 5, 1923. (*C. A.*)

Glassworking apparatus. JESSE M. SAID and DAVID E. GRAY. U. S. 1,501,868, July 15, 1924. In a machine for pressing articles of glass, the combination of vertical standards having slidably mounted thereon a plunger cross head, and levers for actuating said plunger cross head, the levers both having a floating fulcrum and a floating point of resistance separated from each other.

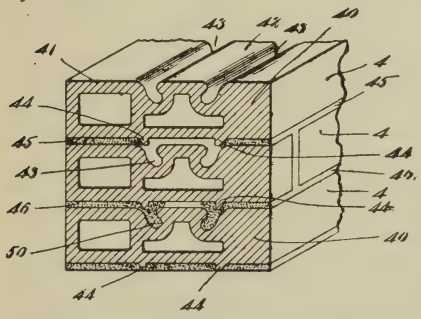


Detergent. F. BRAUN. U. S. 1,494,147, May 13. A soln. for cleaning glass or ceramic ware is formed of alc. 40, glycerol 4, 5% soln. of citric acid 60 and dil. HOAc 24 parts.

Heavy Clay Products

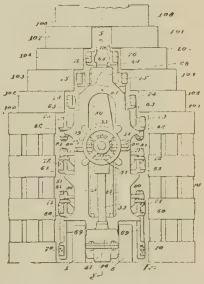
Sand-lime brick process. ANON. *J. Soc. Chem. Ind.*, **43,** 508(1924).—Sand is mixed with 5–10% slaked lime, and the thoroughly mixed semi-dry mass is put through a brick molding machine operating at 2 tons per sq. in. pressure. It is then exposed for 10 hours in closed cylinders to steam at pressure 120 lbs., temp. 350°F. The lime must contain not the slightest trace of unslaked lime, otherwise the bricks expand or become distorted, or they are weak and friable. Sand-lime bricks have a crushing strength of 330 tons per sq. in., and they are less absorbent to water than ordinary bricks, while possessing equal porosity as regards air. Every brick is a "facing" brick, and they require less mortar to lay them.

H. H. S.

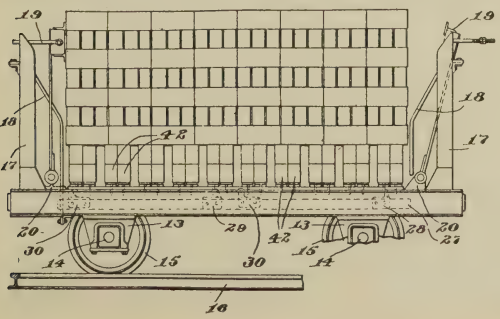


PATENTS

Brick and wall construction. GRAFTON E. LUCE. U. S. 1,503,327, July 29, 1924. A building unit eccentrically weighted and having a handhold positioned eccentrically with regard to the unit, but directly over its center of gravity.



Collapsible arch-form for brick-kilns. GRAFTON E. LUCE. U. S. 1,500,949, July 8, 1924. Apparatus of the kind described, consisting in a form for setting arches in a brick kiln, having brick engaging and aligning means for both sides and top of the arch, in combination with means to withdraw the brick engaging members before the form is removed from the arch, said withdrawing means simultaneously drawing inwardly and downwardly the brick engaging members.



Finger-course unit car. CLAUD E. FULLER. U. S. 1,503,452, July 29, 1924. In an improved finger-course unit car, the combination of a frame, a plurality of parallelly arranged bars or plates extending laterally of said frame, and means for arranging said plates or bars in pairs.

Refractories

Grading of silica bricks. P. B. Robinson and W. J. Rees. *Trans. Cer. Soc.* (Eng.), **23**, 1–12.—Seven brands of silica brick made from rock contg. 95–98% silica mixed with 1.5–2% lime were examd. both in the green state and after firing. Conclusions: (*a*) A hard fine-grained rock crushing into fragments of high angularity should be used. (*b*) Grinding should be such that the largest particles will be about 6–7 mm. in diam., with about 40% of the mat. retained on a 30-mesh sieve. These large angular particles give strength to both the green and burned brick. (*c*) With the ganisters ordinarily used the above specif. for coarse mat. will produce more than 40% of mat. passing through a 90-mesh sieve. This fine mat. is necessary to produce compactness in the brick and for the production of a melt which will promote the inversion of the quartz on burning. H. F. S.

Tridymite and tridymite bricks. O. Rebuffat. *Trans. Cer. Soc.* (Eng)., **23**, 14–5.—Refers to previous note and patents (*Trans. Cer. Soc.* (Eng.), **21**, 66). If quickly raised to 1400°C coarsely powdered quartz blended with a very small quantity of "multiple catalyst" is completely transformed after 5 or 6 hrs. heating with an increase of vol. of $^1/_6$ or $^1/_7$ and production of a product having a sp. gr. of 2.23 to 2.26 "which must consequently be considered as almost pure tridymite." This mat. does not change in density on further htg. until 1700°C when vitreous silica is formed. R. does not believe that cristobalite is necessarily formed by htg. tridymite above 1450°C. H. F. S.

The effect of salty coal upon refractory materials. L. M. Wilson. *Trans. Cer. Soc.* (Eng.), **23**, 39–50.—The effect of ammonium chloride on fire clay and silica brick was studied. Conclusions: (1) Confirm observation by J. W. Cobb that solids interact at temps. below the fusing point of either. (2) There is a critical temp. of 900°C where the chem. properties of burned fire clay seem to undergo a change quite apart from the critical temp. where the phys. properties of either raw or fired mat. are known to alter. (3) Silica refractories are superior to fire-clay refractories in resistance to salty coal. (4) At temps. between 700° and 1200°C ammonium chloride removes iron and alumina from fire-clay bricks or iron, alumina and calcium from silica bricks. H. F. S.

Reducing the cost of relining boiler furnaces. Anon. *Power*, **59** [26], 1028 (1924).—A method is described of patching old fur. linings by means of a refrac. cement of suitable properties so that it may be shot into cracks and crevices by means of a cement gun. The cement is a mixt. of ground fire-brick bats and silicate of soda. The article is illustrated with fur. wall photographs showing the character of fur. walls before and after relining the walls. C. J. H.

Ground fire brick for furnace repair. Joseph Harrington. *Power*, **59** [25], 976(1924).—In the Cleveland Elec. Illuminating Co. plant, fur. walls are laid up with thick joints of a refrac. cement made of fire-brick grog mixed with a refrac. cement. Other fur. walls are of monolithic construction using this cement. The grog in the cement is ground fire-brick bats of the same quality as the brick of the walls. A dry pan is used to prep. the grog. A saving is claimed in laying up new walls with thick joints of this cement. The monolithic walls apparently show long life. C. J. H.

Furnace linings. Guy B. Randall. *Power*, **60** [4], 146(1924).—The refrac. mat. bonding agent and method of application are 3 important elements of a fur. job. Arches and walls made of fire-brick of uniform dimensions and laid up without bonding agents are emphasized. Photographs are shown of fur. walls which have been laid up with thick joints, the bonding agent running high in ground fire brick; and photographs of walls relined by the use of a cement gun. C. J. H.

Dolomite. L. M. PARSONS. *Trans. Ceram. Soc.* (Eng.), **22,** 323–32(1922–23).—Dolomite (first described by Dolomieu in 1781) is the double carbonate of Ca and Mg and is distinct from the mixt. known as magnesian limestones. It contains 45% $MgCO_3$. Dolomite rocks are grouped as primary or secondary. *Primary* dolomites are produced originally in the dolomitic state, either chem. by evapn. of salt-lake waters (*pptd.* or *proto*-dolomites), or mechanically by sedimentation of the prototype. *Secondary* dolomites are formed by chem. alterations of limestones, the influence being usually dissolved Mg salts, but, in rarer cases heated vapors contg. Mg compns. Secondary dolomites may be "contemporaneous" or "subsequent"; in the former type, limestone on the sea-floor is acted on by the Mg salts in soln. before the limestone becomes hard; in the latter, ground waters contg. Mg salts percolate through limestones which form part of dry land. In many cases, the ground waters have affected a limestone here and there so that the dolomite is in veins, streaks and patches. Most commercial dolomites are of the contemporaneous class. P. gives examples of all these types as they occur in England. H. H. S.

The manufacture of refractories in America. A. F. GREAVES-WALKER. *Trans. Ceram. Soc.* (Eng.), **22,** 358–76(1922–23).—A description of American methods: The hand-made, stiff mud or steam press, soft mud, and dry press processes; drying methods, setting methods; burning methods, tunnel kilns; magnesite and chrome products; hand-made and machine-made silica products; plant equipment and organization. The English discussion centered on the size and waste space of tunnel kilns; appreciation of machinery like the discharging revolving bottom pan and poidometers; humidity driers; and the danger of hasty work incurred by allowing men to leave work early. H. H. S.

The specific heat of magnesite brick at high temperatures. A. T. GREEN. Communication No. 103, Stoke-on-Trent Clay and Pottery Lab. *Trans. Ceram. Soc.* (Eng.), **22,** 393–7(1922–23).—Using 300 g. of mat. and 45 l. of water, G. obtd. the following values for actual sp. ht. at a def. temp.:

Temp.	100°C	200°	400°	600°	800°	1000°	1100°
Sp. Ht.	0.239	0.250	0.271	0.293	0.313	0.334	0.345

This does not confirm Tadokoro who obtd. a max. at 600°C, using 3 g. of mat. in a Pt crucible. Bradshaw and Emery, and Heyn, Bauer and Wetzel, obtd. no such max. H. H. S.

The use of refractory materials in gas works. G. M. GILL. *Trans. Ceram. Soc.* (Eng.), **22,** 377–92(1922–23).—The temp. of carbonization has in recent years been increased from 1280°C to 1400° in order to obtain a 50% increase output, and retorts which had a life of 1000 working days are now reqd. to be more permanent. The best mat., silica brick (95% SiO_2), often shows too much after-expansion and has to be built up instead of molded; it has also a tendency to spall. Fire clay shows too much after-contraction and a tendency to soften under load. G. suggests a semi-silica mat. contg. 76–92% SiO_2 according to the position in setting and the purpose for which it is required. 75% of the mat. should have an expansion or contraction of not more than 1% at 1400° C under load, and the remaining 25% not more than 1% at 1280° under load. Combustion-chamber arches should be of 95% SiO_2. The standardization of dimensions of fire bricks and blocks is recommended. Diagrams accompany the paper. H. H. S.

Keramonit and thermonit. H. BECK. *Feuerungstech.*, **12,** 97–8(1924); *St. u. E.*, **44,** 634–5(1924).—Two new refractories. H. H. S.

The effect of coal ash on refractories. J. J. BRENNAN. *Combustion*, **10,** 418–22 (1924).—The metallurgical point of view is adopted, wherein the ash from the coal and the furnace lining are compared to a smelter charge and lining. Chem. analyses are

given of 9 coals and their ashes and of 14 bricks, Fe-free. Mixts. of 70% ground fire brick and 30% coal ash were prepd., each brick in combination with each ash, and molded into triangular cones, inclined at a 45° angle with the horizontal. These were mounted on slabs of highly refractory material. Similar cones were prepd. from each ash and from each brick alone. These were heated in a gas-fired furnace in a reducing atm.; 4 hrs. was required to reach the max. of 3000°F. The condition of the cones was observed at 20° intervals. The temp. of initial deformation of the cones, *i. e.*, when the tip assumed a horizontal position, was noted and the results were plotted. In the majority of cases, actual life of furnace linings follows closely the indications given by the charts. J. F. B. (*C. A.*)

Refractory products. I. J. M. TEUNISSEN. *Het Gas*, **43**, 276–82, 323–7, 351–5 (1923).—A review on the material used for molding fire bricks, their methods of prepn. and their application in industry. R. B. (*C. A.*)

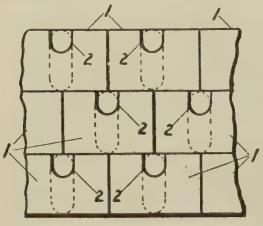
Modern British blast furnaces. FRED. CLEMENTS. *Iron Coal Trades Rev.*, **108**, 959–64, 1024(1924).—A description of 4 blast furnace units, with detailed drawings of furnaces and stoves. J. F. B. (*C. A.*)

New use for refuse refractory material. S. F. WALTON. *Iron Age*, **113**, 786–8 (1924).—Old fire-clay brick bats are ground up with a bond to form a highly refractory mortar. Economies claimed are: the mortars are inexpensive, the mortar and plaster conserve fire-brick walls and arches, the new plaster can be applied instead of relaying brick, and fuel is conserved by the prevention of air infiltration through cracks. W. H. B. (*C. A.*)

The study of refractory products. II. P. DEMASURE. *Bull. fed. ind. chim. Belg.*, **3**, 238–56(Mar., 1924); cf. *C. A.*, **18**, 1887.—A review and discussion of the strength of various refractories, particularly at high temps., and description of an app. for measuring their compressive strength at temps. up to 1500°. WM. B. P. (*C. A.*)

PATENTS

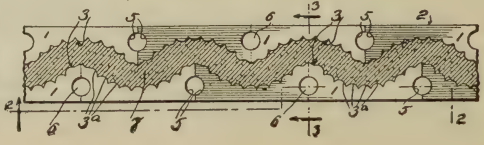
Refractory article and method of making the same. CLARENCE J. BROCKBANK. U. S. 1,503,150, July 29, 1924. A refrac. article of graphite and clay vitrified in an atmosphere of hydrocarbon gas and characterized by relatively increased hardness at high temp. and relatively increased refrac. properties.



Checker brick. JOSEPH HOGBIN and WILLIAM LEHMAN. U. S. 1,500,455, July 8, 1924. In a checker structure, a plurality of parallel supporting walls, and cross members rockably supported in spaced relation between said walls.

Refractory materials for lining furnaces, etc. J. HODSON. Brit. 211,944, Nov. 28, 1922. Bricks, furnace linings, retorts or similar products are formed from rocks contg. $MgCO_3$ and $CaCO_3$ together with either (*a*) talc or other form of Mg silicate, (*b*) igneous rocks with or without basic Fe cores, or either *a* or *b* plus silica sand; *e. g.*, SiO_2 15, serpentine 5, raw dolomite 10 and burnt dolomite 70%. The materials may be molded with or without a glutinous binder and then burnt or may be burnt to a plastic state and then molded. Raw magnesite 92.5, SiO_2 sand 5 and clay 2.5% also may be used. (*C. A.*)

Terra Cotta



Tile and terra-cotta block. WILLIAM HENRY GRUEBY. U. S. 1,501,709, July 15, 1924. A tile block having an outer substantially flat facing side and an inner surface pro-

vided with inwardly extending projections at the middle portion and at opposite ends, the middle projection having a vertically disposed recess of suitable dimensions wholly within the same and the end projections having recesses of a portion of the area of the recess of the middle projection, whereby when stacked two of the end recesses will register with a middle recess to form continuous channels.

White Wares

Black and grey flint. A. Heath and A. Leese. *Trans. Ceram. Soc.* (Eng.), **22,** 313–6(1922–23).—Flint was suspected as the cause of a form of stunting known as "chittering" which does not always appear immediately after the ware is drawn from the glost oven, but is liable to occur subsequently to decoration or even in the warehouse. Black flint and grey flint were therefore calcined at the same temp., and plates of standard earthenware made with each, and fired, biscuit and glost, in the same sagger. After standing a few weeks, the bodies made with grey flint were found to be more liable to chittering than those made with black flint. The sp. gr. of the flints were: grey 2.471, black 2.467. They were ground to 160 mesh, with approx. 1% residue. In the discussion A. G. Richardson said chittering was due to four faults: (1) grey flint, (2) overground flint, (3) excess of flint, (4) displacing hard purple stone by mild stone. H. H. S.

Chemical stoneware and its applications. M. A. Knight. *Chem. Met. Eng.,* **28,** 689(1923).—Chem. stoneware is a hand-molded product easily available for special shapes. It is usable in every industry where corrosive liquids are found.

W. H. B. (*C. A.*)

BOOK

Benischke, Gustav: **Die Porzellan-Isolatoren.** 2nd revised ed. Berlin: J. Springer. 116 pp. (*C. A.*)

Equipment and Apparatus

Notes on the Proctor drier. A. H. Middleton. *Trans. Cer. Soc.* (Eng.), 51–60.—Describes an English installation of this drier used for drying brick, coke oven shapes and gas retort segments, varying in wt. from 2 lbs. up to 230 lbs. each. H. F. S.

Improvements in drying refractories or other goods. J. Holland and W. J. Gardner. *Trans. Cer. Soc.* (Eng.), **23,** 16–25.—Describes a continuous tunnel drier for silica brick. The tunnel is 3 ft. wide and 60 ft. long and quite shallow. A fire box is built under one end of the tunnel and the flue from this runs under the floor of the tunnel to near the other end and then into a stack. The floor and side walls are made of refrac. slabs. At the rear (cold) end of tunnel is a cooling chamber which is cut off from the drying chamber by a damper or door. The bricks to be dried are placed *only one high* on wrought iron plates at the furnace end of the drier. These plates are attached one to the other and drawn through the drier on rollers by suitable mech. means. The moisture is drawn out by a stack at the hot end of the drier. A two tunnel drier will dry 5000 silica brick in 9 hrs. with a temp. of 100°C at the center of the drier above the brick, using 400 lbs. of coal. One man takes this number of bricks from the drier and returns the drier plates to the feed end. H. F. S.

Collecting flint dust. A. E. Harris. *Trans. Cer. Soc.* (Eng.), **23,** 26–38.—Discusses dust collection app. in general and describes in particular a typical suction filter dust collector. H. F. S.

Note on the abrasion of fire clay materials. W. C. Hancock and W. E. King. *Trans. Ceram. Soc.* (Eng.), **22,** 317–22(1922–23).—The methods in use for detg. abrasion, *viz.,* the Bauschinger grinding mach., the "wearing" (sand-blast) test, and the "rattler" test, cause abrasion not by direct rubbing but rather by grinding, and further, expts. can only be carried out within a strictly limited range of temp. The authors used a

long metal arm, jointed in the middle, one end of which was attached to an eccentric driven by an elec. motor. The other end was fitted with a small metal clamp to hold the test-piece, which was moved backwards and forwards over the surface of a fixed block which might be of the same or different mat. so that really the mutual abrasion was detd. The per cent loss of wt. was taken as a measure of abrasion; when very small it may be reckoned as the "loss per 10,000 strokes." Detns. were not begun until after the first hour of abrasion. The conclusions are: (1) Fine-grained bricks resist abrasion more than coarse-grained, and admixt. of grog, both as regards size of grain and quantity, decreases resistance; (2) Abrasion increases at higher temps; (3) Hard-firing of bricks decreases abrasion; (4) Addition of load to wearing surfaces increases abrasion. H. H. S.

Humidity recorders. E. B. WHEELER. *Bell System Tech. Jour.*, **3** [2], 238–59 (1924).—An account is given of a recording hygrometer consisting of a ventilated psychrometer (wet and dry bulb thermometer) together with a Leeds and Northrup potentiometer recorder, resistance thermometers, a double wheatstone bridge circuit and the necessary wind tunnel equipment. As the chief difficulty encountered in the use of the wet bulb thermometer has been the gradual clogging and drying up of the cotton wick, special pains must be taken to remove all traces of grease from the wick at the start and to keep dust out of the distilled water. Charts and data are given showing comparison of results obtained in the laboratory with the recorder and with a ventilated psychrometer equipped with accurate mercury thermometers. Very satisfactory agreement was obtained over a range of relative humidities from 54 to 97%. Interesting figures are given showing indoor and outdoor temps. and relative humidities, from which it appears that the humidity indoors may be kept below that of the outside air by closing the windows during sudden changes (storms), and by the application of ht. This is important in telephone exchanges, where the elec. equipment is sensitive to humidity. Finally a modification of the recording hygrometer is described, which registers relative humidity directly. In this app. a Leeds and Northrup recorder with two pens is employed, one for registering dry bulb temps. and the other for relative humidity. While both instruments are said to be practical for general use, the author emphasizes the need of intelligent care and skill in maintenance of the app. A. F. G.

The use of conveyors in chemical works. HARTLAND SEYMOUR. *Chem. Age* (London), **9**, 565–6(1923).—Conveyors may be classed as continuous and pneumatic. Continuous conveyors carry the material on a continuous band, have push plates, scrapers, pans, slats, or buckets bolted to an endless chain, or are constructed on the principle of a spiral rotating in a trough. The pneumatic conveyor is gaining in favor. It has even been used successfully in handling atomized lead, weighing 450 lbs. (19.6 kg.) per cu. ft. (0.028 cu. m.). W. H. B. (*C. A.*)

The power-load curves of ball mills. A. O. GATES. *Eng. Mining J.-Press*, **113**, 485–7(1922).—A simple lab. app. for exptl. work on power-load curves is described. The power varies directly with the charge up to half load, reaching a max. at 60–75% of the mill capacity. A curve is shown for a cylindrical mill at various speeds and loads. Power in ball mills is consumed as (*a*) friction losses in bearings, and (*b*) energy spent upon the free balls or pebbles within the mill and by them spent upon the ore, or other pebbles, or in the lining, or returned to the mill. The friction load is practically const. for all loads at const. speed. The h. p. developed by the mill in raising the balls equals $r^{5/2} \times$ a const., when r = radius of mill. W. H. B. (*C. A.*)

Route your materials via air line. F. L. JORGENSEN. *Chem. Met. Eng.*, **28**, 932–8 (1923).—A study of pressure and vacuum systems of pneumatic conveyance. Each may be classified as low, medium, and high. Layouts are shown for a high-vacuum conveying system, and a system with dust filtration; also for handling fertilizer, lithopone Pb and bauxite. W. H. B. (*C. A.*)

Kilns, Furnaces, Fuels and Combustion

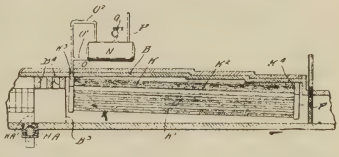
Smaller furnaces for pulverized coal. OLLISON CRAIG. *Power*, **60** [4], 145 (1924).—One of the handicaps of the use of powdered coal is the necessity of large *fur*. Work on small fur. will require speeding up of the rate of combustion of the coal; this in turn will mean higher fur. temp. with refrac. capable of withstanding them. A fur. has been constructed where extensive research and exptl. work can be done. A portion of the fur. is lined with special refractory brick and a portion with standard fire brick for purposes of comparison. A unit powdered coal machine has been installed to supply the coal. C. J. H.

Traveling grates, changing fuels, and self-cleaning. PRADEL. *Wärme & Kälte Tech.*, **26**, 81–3(1924).—P. describes and illustrates rather imperfectly a new type of traveling grate, in which the links or sections are easily renewable, and which does not become clogged with clinker. E. W. T. (*C. A.*)

PATENTS

Tunnel kiln for burning porcelain, bricks, tiles, lime or other materials. N. LENGERSDORFF. Brit. 211,894, Feb. 26, 1923. The kiln is heated by oil or gas burners. (*C. A.*)

Tunnel kiln with steam-generating cooling zone. CONRAD DRESSLER. U. S. 1,503,750, Aug. 5, 1924. In a tunnel kiln in which the kiln chamber comprises a heating zone and a cooling zone successively transversed by the goods passing through the kiln, the improvement which consists in a steam generating unit comprising water heating elements located in the kiln chamber in position to abstract heat from the goods as the latter pass through said cooling zone.



Vertical kiln adapted for drying clay, gypsum, etc. A. BIGOT. U. S. 1,497,084, June 10. (*C. A.*)

Geology

Clay mine reopened. ANON. *Chem. Age*, **9**, 15(1924).—Clay deposit at Bennington, Vt. has been reopened and is being operated by the Vermont Kaolin Corp. 50,000 T. had been removed from it since 1865 when opened by Lafayette Lyons. Was used as enameling clay, china clay, crude fire clay, and paper coating. Is equal in quality to English clays. Has been closed since 1909. The mine is 65 ft. deep and the seam is like a damp chalk containing fine silica sand. It is made up into sludge and coarse sand settles out while the finer is removed by a hydraulic bowl classifier to 350-mesh size. The refined kaolin is discharged and sent to the rotary drier. It is expected to produce 6000 tons per year with 20 men employed. S. S. C.

Petroleum possibilities of western Oregon. WARREN DE PRE SMITH. *Econ. Geol.*, **19** [5], 455–65(1924).—Describes drilling in various sections of Ore., and cites results to show that, except in the Ashland district, where oil shales are found, the results are all negative. From present indications, W. Ore. is a territory of possible but not probable petroleum reserve. C. W. O.

Types of magnesite deposits and their origin. GEORGE W. BAIN. *Econ. Geol.*, **19** [5], 410–33(1924).—Magnesite deposits that are being or have been worked can be divided into four types: (1) magnesite as a sedimentary rock; (2) magnesite as an alteration of serpentine; (3) magnesite as a vein filling; (4) magnesite as a replacement of limestone. Of these only the 2nd and 4th are of economic importance at the present time. The most important and complex is that which has been termed the replacement type. Deposits of the replacement type in at least two cases are normal limestones replaced by magnesia-bearing soln. emanating from granite magma. A similar origin seems to apply to the lesser known Washington occurrence. The solns. were

in the form of silicates when they reached the limestones. The sol. at a certain stage pptd. out as serpentine and talc, rather than as anhydrous minerals as is usually believed to be the case. Almost simultaneously any anhydrous minerals already formed became hydrated. Reaction between the limestones and dolomites and the silicate-bearing soln. formed magnesite or dolomite, depending upon whether the rock traversed by the soln. was a dolomite or a limestone. The wollastonite formed during the reaction was carried away in soln. as in the case of the silica in the formation of the magnesite veins in the better known deposits in serpentine. The sedimentary deposits seem to be formed in salt lakes chiefly by pptn. of the less sol. $MgCO_3$ formed by chemical reaction but probably helped by evapn. The vein deposits constitute a variety of the ordinary fissure vein deposits of magmatic origin. Deposits in serpentine are due to the alteration of serpentine by carbonated waters, seeming, in most cases, to be of magmatic origin. Transportation and selective pptn. are an important feature in forming workable deposits. Magnesite from deposits of sedimentary origin or from deposits in serpentine is usually very uniform and free from objectionable constituents. Magnesite from fissure veins is very ferruginous, due to the presence of $FeCO_3$. Magnesite from replacement deposits is variable and requires careful sampling. The quality of a shipment is the quality of the poorest piece in it. C. W. O.

Note on andalusite from California: a new use and some thermal properties. A. B. Peck. *Am. Mineral.*, **9**, 123–9(1924).—A com. deposit of andalusite occurs on White Mt., Inyo Range, Mono Co., Calif. The andalusite rock is coarse granular, compact and gray to light pinkish brown. Coarse crystals occur in cavities, having the forms *k* (210) and *r* (101). The material as mined runs 75–85% andalusite, but owing to the presence of corundum chem. analysis shows about 90% Al_2O_3. Associated minerals are: lazulite, pyrophyllite, muscovite, deep blue corundum, microscopic inclusions of rutile, and less abundant pyrite, barite, lazurite in quartz veins, and quartz in veins traversing the mass, never in the mass itself. About 70 tons per week are mined for use in the manuf. of spark plugs, where a high content of "artificial sillimanite" is desirable. During the burning of the clay-andalusite mixt. all the andalusite is converted into "artificial sillimanite," $3Al_2O_3.2SiO_2$ (mullite preceding abstract) with an excess of highly siliceous glass. The inversion occurs at about Seger cone 13. At that temp. the andalusite grains change to groups of parallel fibrous crystals of "artificial sillimanite" with narrow strips of glass between. Cyanite goes over to interlocking fibers and glass at cone 11. E. F. H. (*C. A.*)

An unusual occurrence of cyanite. R. C. Wallace. *Am. Mineral.*, **9**, 129–35 (1924).—Reddish cyanite occurs in a sedimentary schist series near a granite contact at Anderson Lake, in the Reed-Wekusko map-area of northern Manitoba. Associated minerals are quartz, micas, chlorite, garnet and staurolite. Conditions favorable to the formation of cyanite would appear to be: excess of Al_2O_3, low alk. and alkali earth content and high temp. The stability of the cyanite here seems to be conditioned by the nearby igneous contact. E. F. H. (*C. A.*)

Geologic literature on North America, 1785-1918. I. Bibliography. J. M. Nickles. U. S. Geol. Survey, *Bull.* **746**, 1167 pp.(1923).—Includes articles of chem. interest. L. W. R. (*C. A.*)

Feldspar in 1922. F. J. Katz. U. S. Geol. Survey, *Mineral Resources of U. S., 1922*, Part II, 251–9(Preprint No. 27, published Mar. 6, 1924). E. H. (*C. A.*)

Chemistry and Physics

Technology of zirconium and its compounds. F. C. Nonamaker. *Chem. Met. Eng.*, **31**, 151–5(1924).—A review of the methods of preparation of the element and its oxide from the ore, and its application in the metallurgical and ceram. industries. M. E. M.

The zenith temperature. J. W. MELLOR. *Trans. Cer. Soc.* (English), **23,** 13.—Assuming that known phys. laws hold good at excessively high temps. the highest possible temp. is something less than 4 million million deg. abs., or 4,000,000,000,000°C.

H. F. S.

The physical properties of clay. S. E. ACKERMANN. *Trans. Ceram. Soc.* (Eng.), **22,** 333–43(1922–23).—A London clay of anal.: SiO_2 57%, Al_2O_3 19, Fe_2O_3 5, CaO 4, H_2O combd. 9, and sundries 6, was tested for penetration by weighted piles. Three sets of expts. were: (*a*) Square pyramids forced in, point downwards; (*b*) piles of various cross-section, some pointed, and some square or blunt-ended; (*c*) discs. A close relationship was found between the law of penetration into clay and into metals. Thus with pyramids of square side *b* mm. long, $b = 2.22E^{1/3}$ in clay contg. 30% water (the vertex angle of pyramid being $37^1/_2°$); and with tin Edwards and Willis found $d = 2.186\ E^{1/4}$ where *d* was the diam. in mm. of indentation caused by a 10 mm. diam. ball; *E* in the clay formula being the work done in cm. kilos, and, in the tin formula, the energy of the blow in lb.-ins. The connection between the *tensile strength* of London clay and its water content is given as:

	Grains per sq. cm.
28% water	80
26	140
24.5	200
23	300
5	13,150

the percentage of water being calculated from the loss on drying for 2 days at 180°F. Expts. on the *tortional elasticity* of a rolled cylinder 68 cms. long of clay contg. 28% water showed that the lower end could be twisted through an angle of 32° and on release would return instantly to zero. This could be repeated several times, but if the twist was more than 32° the permanent set was equal to the excess of twist over 32°. The *breaking load* of a clay cylinder 23 mm. diam. and 25 cm. long, dried at 180°F., and loaded at the center, was 14.87 kilos. *Shearing tests* showed that coeff. of friction of clay is not constant at the same percentage of water, but varies inversely as the sq. root of the pressure between the surfaces, $\mu = \frac{9.47}{\sqrt{p}}$ at 25% water. When a cylindrical pile is driven into clay, 80% of the load is supported by side friction and only 20% by vertical pressure. *Pressure of fluidity*, obtained by dividing the critical load by the area of the disc, is connected with the tensile and shearing strengths ($p = 3.68C + 5.21f$) and as these are factors of *plasticity*, it is suggested that press. of fluidity which is easily detd. be used for comparing plasticity of diff. clays, or of the same clay with diff. per cent water. The *extrusion* of clay through circular orifices showed that on doubling the area of orifice the discharge of clay is quadrupled, clay thereby differing from water.

H. H. S.

The outlook in chemistry. W. J. POPE. *J. Soc. Chem. Ind.*, **43,** 566–71(1924).—(Trueman Wood Lecture to Roy. Soc. of Arts.) The sudden development of physics during the last 20 years has unified chem. and physics. What were theories or mere hypotheses are now actual statements of fact. During the next few years we may expect to learn the cause of the great stability of the benzene ring, the basic principle underlying tautomerism, the origin of color in quinones, and why copper, of atomic number 29, refuses to form organo-metallic compds., while Zn, Ga, Ge, As, Se, Br, of at. numbers 30–35 all combine with methyl radicles. A quantitative explanation of the energy changes of chem. reactions, an exposure of the mechanism attending chem. changes and particularly catalytic reactions, should be forthcoming. The importance of catalysis in bio-chemistry cannot be exaggerated. Research by team work is stressed.

Instead of Ehrlich's 606 for syphilis, and Baeyer's 205 for sleeping sickness, scores of thousands of chem. subs. should be systematically studied for all diseases. The Natl. Phys. Lab. is initiating a systematic investigation of alloys by studying the alloys of pure Fe and Cr. H. H. S.

Chromates of thorium and the rare earths. H. T. S. BRITTON. *J. Soc. Chem. Ind.*, **43**, 485(1924).—La, Pr, Nd, and Sa, form isomorphous yellow chromates of the general formula $M^{III}_{2}(CrO_4)_3, 8H_2O$. Variations in soly. allow of fractional pptn. with K_2CrO_4. The tendency to form sparingly sol. double chromates is marked in the cases of La, Pr, and Sa. H. H. S.

The behavior of clays, bauxites, etc. on heating. II. H. S. HOULDSWORTH AND J. W. COBB. *Trans. Ceram. Soc.* (Eng.), **22**, 344–8(1922–23).—The earlier work (reference p. 48, 1924) showed that the shrinkage of clays on heating is not continuous, but occurs in well-defined stages, in kaolin notably at 530°, 880°, 950°, and 1050°. The present work deals with porosity, sp. gr., and refractive index. Sp. gr. of kaolin is 2.642 at 110° and 400°; it then decreases to 2.510 at 500° and increases to 2.688 at 1000° the largest increase being between 850° and 950°. Porosity is 46.9% at 110° and 400°; it increases to 48.5% at 450° and slowly to 51.3% at 1000°. Refractive index is 1.564 at 110° and 400°, decreases to 1.516 at 550°, is 1.522 at 600° and 1.518 at 650°, and then increases to 1.549 at 1000°. This work shows that definite changes in the kaolinite mol. occur at 450°, 880°, and 950°, with minor changes at 625°, 680°, and 760°. Density and refractive index reach their min. with complete dehydration. H. H. S.

On the behaviour of kaolin on heating. W. J. VERNADSKY. *Trans. Ceram. Soc.* (Eng.), **22**, 398–401(1922–23).—Houldsworth and Cobb's work (preceding abstract) is attacked on the ground that the kaolin used was impure. Mellor's theory that kaolin on heating gives free SiO_2 and Al_2O_3 is not accepted. The mineral group kaolin, feldspar, mica, leucite, etc., contains a complex nucleus $Al_2Si_2O_7$ which remains unchanged during the various transformns., one into another, which these minerals are constantly undergoing. The only case where this linkage between Al and Si atoms is broken at a low temp. is in the formn. of laterite, which occurs under peculiar conditions and is analogous to a biochem. process. V. supposes that at 420–530°C kaolin forms an anhydride $Al_2Si_2O_7$, leverrierite. At higher temps. the critical point on the heat curves corresponds to polymorphic changes in $Al_2Si_2O_7$. Le Chatelier's exothermic reaction at 930–950° corresponds to the destruction of the nucleus and the setting free of mols. of SiO_2. In a footnote to this paper, Mellor says his work has been confirmed by Tammern and Pope (*Z. anorg. Chem.*, **127**, 43(1923)) and by Satoh (*Sci. Rep. Tohoku Univ.*, **1** [3], 157(1923)). H. H. S.

Isotopes. ANON. *J. Soc. Chem. Ind.*, **43**, 636–7(1924).—The following is a list of the isotopes now known:

Element	At. number	At. weight	Masses of isotopes in order of intensity of spectral lines
H	1	1.008	1.008
He	2	4	4
Li	3	6.94	7, 6
Be	4	9.1	9
B	5	10.9	11, 10
C	6	12.005	12
N	7	14.008	14
O	8	16	16
F	9	19	19
Ne	10	20.2	20, 22
Na	11	23	23

Mg	12	24.32	24, 25, 26
Al	13	27	27
Si	14	28.1	28, 29 (30)
P	15	31.04	31
S	16	32.06	32
Cl	17	35.46	35, 37
A	18	39.9	40, 36
K	19	39.1	39, 41
Ca	20	40.07	40 (44)
Sc	21	45.1	45
Ti	22	48.1	48
V	23	51	51
Cr	24	52	52
Mn	25	54.93	55
Fe	26	55.84	56, 54
Co	27	58.97	59
Ni	28	58.68	58, 60
Cu	29	63.57	63, 65
Zn	30	65.37	64, 66, 68, 70
Ga	31	70.1	69, 71
Ge	32	72.5	74, 72, 70
As	33	74.96	75
Se	34	79.2	80, 78, 76, 82, 77, 74
Br	35	79.92	79, 81
Kr	36	82.92	84, 86, 82, 83, 80, 78
Rb	37	85.45	85, 87
Sr	38	87.63	88, 86
Y	39	89.33	89
Ag	47	107.88	107, 109
In	49	114.8	115
Sn	50	118.7	120, 118, 116, 124, 119, 117, 122 (121)
Sb	51	121.77	121, 123
I	53	126.92	127
X_e	54	130.2	129, 132, 131, 134, 136, 128, 130 (126)(124)
Cs	55	132.81	133
Ba	56	137.37	138
La	57	138.9	139
Pr	59	140.9	141
Nd	60	144.3	142–150
Er	68	167.7	164–170
Hg	80	200.6	(197–200), 202, 204

H. H. S.

Clay

The structure of Si. H. Collins. *Chem. News,* **129,** 47(July 25, 1924).—The structure studied and proved to be $Na\overset{/}{-}H\overset{/}{-}H_3\overset{\#}{-}H\overset{\#}{}$ where / are electro-positive forces and # are electro-negative forces. H_3–H is non-metallic and Na–H is metallic. This

was further proven by tests using the Law of Relative Vol. and Heat Formation. 13.02 was found to be the commonest vol. of Si. S. S. C.

The volumetric estimation of vanadium in steel. A. T. ETHERIDGE. *Analyst,* **48,** 588–90(1923); *S. u. Eisen,* **44,** 644(1924).—Diphenylcarbazide is used as indicator in titration with $FeSO_4$ and $K_2Cr_2O_7$. H. H. S.

Devitrification phenomena. H. KNOBLAUCH. *Sprechsaal,* **57,** 234–40(1924); *J. S. C. I.,* **43B,** 558–9(1924). H. H. S.

Electromotive characteristics of glasses. H. SCHILLER. *Ann. Physik,* **74,** 105–35 (1924). H. H. S.

Behavior of gases in contact with glass surfaces. D. H. BANGHAM AND F. P. BURT. *Proc. Roy. Soc.,* **105A,** 481–8(1924); *J. S. C. I.,* **43B,** 468(1924). H. H. S.

Color reaction between cobalt salts and dimethylglyoxime in presence of sulphides. F. FEIGL AND L. V. TUSTANOWSKA. *Ber.,* **57,** 762–3(1924); *J. S. C. I.,* **43B,** 580(1924). —After oxime pptn. of Ni, add Na_2S to filtrate. Violet shows Co. Delicate to 1 in 830,000. H. H. S.

Delicate test for zirconium in presence of titanium. L. BELLUCCI AND G. SAVOIA. *Atti. I Congr. Natl. Chem. pur. appl.,* 483–8(1923); *J. S. C. I.,* **43B,** 580(1924).—By nitroso-naphthol. H. H. S.

What is the simplest way of calculating pycnometer density determinations. R. SAAR. *Chem.-Ztg.,* **48,** 285–6(1924).—Rapidity in calcn. can be gained by utilizing the fact that many of the figures used may be expressed as a whole number $\pm$ a small difference. An example will make the method clear: wt. pycnometer full of subst. = 71.564 g.; wt. pycnometer full of H_2O = 70.996 g.; difference = 0.568 g.; wt. of H_2O in pycnometer = 49.925; d. = 1 + (0.568/49.925); 0.568/49.925 = 0.568 $\times$ (1/49.925) = 0.568 [(2 $\times$ 0.49925 + 0.00150)/49.925] = 0.568 $\times$ (0.02 + 0.00003) = 0.01136 + 0.00002 = 0.0114. Hence d. = 1.0114. Simple equations can be used for converting ds. at one temp. to ds. at another. W. H. B. (*C. A.*)

Graphite as a metallic modification of carbon. EUGEN RISHKEVICH. *Chem.-Ztg.,* **48,** 101(1924).—The metallic character of an element is conditioned by the presence of free electrons which make possible the conduction of electricity without simultaneous electrolysis of the conducting medium, the carrying of heat, non-transparency and metallic luster, and the easy transformation into ions with positive charges. Judged by these standards it is shown that graphite may be considered as a metal. W. C. E. (*C. A.*)

The preparation of persilicates. A. H. ERDENBRECHER. *Chem.-Ztg.,* **48,** 310–11 (1924).—82% H_2O_2 added to Na_2SiO_3 yielded a solid substance with an O content of 15.5%; the material could be isolated and identified by microchem. means. Similarly 82% H_2O_2 with $Na_2SiO_3.4H_2O$, $Na_2SiO_3.6H_2O$, and $Na_2SiO_3.9H_2O$ gave solid reaction products, and showed but slight development of heat—unlike the reaction with Na_2SiO_3. Thus, 1 g. $Na_2SiO_3.6H_2O$ and 0.3 cc. 82% H_2O_2 gave a foamy mass which, when rubbed with alc., yielded a brittle solid of the compn. Na_2O 26.08%, SiO_2 26.60%, H_2O 34.41% and O 12.90%. W. C. E. (*C. A.*)

The micro-volumetric determination of arsenic, antimony and tin. A. BRUKL. *Mikrochemie,* **1,** 54–7(1923).—By using $N/500$ I_2 soln. it was found possible to titrate from 0.02 to 1.04 mg. of As within 0.004 mg. of the truth. To obtain this accuracy, it is necessary to add I_2 to the starch indicator so that it is turned blue and to finish the titration at the same tint. Similar results were obtained in the iodometric titration of from 0.08 to 0.84 mg. of Sb. For the titration of Fe^{+++} satisfactory results were obtained with 0.0045–0.51 mg. Fe, $TiCl_3$ soln. kept out of contact with air being used. Automatic micro-burets were used. W. T. H. (*C. A.*)

Flameless surface combustion. J. EX. *Het Gas,* **43,** 355–9(1923).—An historical review, dealing especially with the investigation of W. A. Bone. Application. *Ibid.,*

424–8(1924).—Referring to his previous article Ex describes the first surface burner by Bone, consisting of a diaphragm through which the mixt. of gas and air was blown. Later constructors used grains of fireproof material, heaped up irregularly, instead of the diaphragm. Various designs, especially those of the American Surface Combustion Co., are described. Theoretical considerations. *Ibid.*, **44**, 8–17.—Surface combustion is not a catalytical chem. process since the kind of the surface is of little or no influence, but is primarily detd. by phys. phenomena, *viz.: increased propagation velocity of the wave of combustion along the surface*, larger heat capacity of the porous material, and the very intense mixing of the gases before and after combustion in the capillary cavities. These factors cause the low temp. of the flue gases, *viz.*, the great heat efficiency in Bone-Schnabel boilers and other surface combustion heated machines.

R. B. (*C. A.*)

Analysis of products rich in alumina. H. Hiller. *Z. angew. Chem.*, **37**, 255–6 (1924).—In the analysis of products such as corundum fusion with borax is more satisfactory than fusion with either soda or alkali pyrosulfate. Melt granular borax in a Pt crucible until a layer 5–6 mm. thick is obtained. Cool, and weigh 0.5 g. of sample into the crucible contg. the borax. Fuse slowly, cool and dissolve the melt in dil. HCl. The further progress of the analysis is normal. W. T. H. (*C. A.*)

BOOKS

A Dictionary of Applied Chemistry. E. Thorpe. Vol. V. Oxygen-Rye. Revised and enlarged edition. Pp. viii + 722. London; Longmans, Green & Co., 1924. Price 60 s. Net. H. H. S.

Colloid Chemistry. The Svedberg. New York: The Chemical Catalog Co. 1924. Pp. 265.—This book is in the true line of scientific authorship. Instead of retailing second- and third-hand references from other volumes, it describes the author's researches at Upsala, and discusses the work of other people in the light of his own experience. The sections are: (I) Formation of the Colloid Particle, (II) The Colloid Particle as a Molecular Kinetic Unit, (III) The Colloid particle as a Micell, a micell being defined as the particle together with its surrounding or adsorbed molecules and ions and probably a part of the surrounding liquid or gas. H. H. S.

Lehrbuch der Metallographie, Chemie u. Physik der Metalle u. ihrer Legierungen. G. Tammann. 3d Ed. Leipzig: Leopold Voss, 1923. xviii + 450 pp., 249 figs. M. 14.50. H. H. S.

An Account of the Achievement, and the Present State of Knowledge in Chemical Science. London: E. Benn. 1924. viii + 281 pp. Price 15 s. Twenty-four essays written by experts in each selected branch of chemistry. H. H. S.

Reports of the Progress on Applied Chemistry. Vol. 8. London: Soc. of Chem. Indus. Price 12 s.—Contains section on glass, and one on ceramics, building mat. and refrac. H. H. S.

PATENTS

Removal of brown coloration in china clays. L. A. Holden. Eng. pat. 214,699, Jan. 19, 1923; *J. S. C. I.*, **43B**, 514(1924). H. H. S.

Manufacture of red oxide of iron. Daniel Tyrer. U. S. 1,501,873, July 15. A method of manufacturing red oxide of iron, which consists in mixing ferrous chloride with hydrated ferric oxide in a very fine state of subdivision and passing a mixture of air and water vapor over this product at a temperature of 250° to 300°C.

Process of making lead nitrate and hydrated manganese dioxide. Eric Hjalmar Westling. U. S. 1,502,079, July 22. The process of producing hydrated manganese dioxide and lead nitrate which comprises reacting manganese nitrate with lead peroxide.

General

The X-ray analysis of coal, and a new X-ray examining unit. C. N. Kemp. *J. Soc. Chem. Ind.*, **43**, 234 T–235 T(1924).—X-ray methods applicable to coal resolve into three groups: (1) Bombardment by rays of known penetrating power and intensity, and observn. of modifications effected. (2) Examn. by radioscopic, sterioradioscopic, radiographic, stereoradiographic, and radiodensimetric methods of the nature and distribn. of extraneous matter in coal, based in each case on the varying absorpn. of the rays, and detd. visually, photographically, or by ionization methods. (3) Examn. of the elementary cryst. constituents by X-ray diffraction. The examg. unit consists of a steel tank provided with an insulating lid and contg. a transformer (65,000 volts) with a Coolidge tube of the radiator type clamped above it, so that the cone of rays from the target of the tube is projected vertically upward, through a glass or Al window. The tank is filled with special oil to immerse both transformer and tube. For safeguards in dealing with the rays after emergence, consult recommendations of X-Ray and Radium Committee, and Radiolog. Section of (Eng.) Natl. Phys. Lab.

H. H. S.

The French ceramic congress. Anon. *J. Soc. Chem. Ind.*, **43**, 721(1924).—Held in Paris, June 2–6. Frion and Linke described two years' tests at Sevres of crude oil and tar as liquid fuel for kilns. One kg. of crude oil replaces 7 kg. of wood, a ht. economy of over 50%. The time of burning was reduced from 24 to 11 hrs. Natural and artificial draughts were discussed. Cazeneuve dealt with discontinuous or cellular driers as compared with continuous driers. H. H. S.

Chemical engineers. A joint conference of the Amer. Institute of Chemical Engineers and the British Institution of Chemical Engineers will be held in England in July, 1925. H. H. S.

Comparison of types of fireproof construction. Chester L. Post. *Jour. W. Soc. Engrs.*, **29** [5], 278–89(1924).—A discussion of types of fireproof construction based on the requirements of the Chicago Building Ordinance. The materials considered as filling the conditions of fireproof covering are: (1) burnt brick; (2) tiles of burnt clay; (3) approved cement concrete; (4) terra cotta. A very clear, condensed presentation of mat. and types of construction is given. Of especial interest are the following, together with a statement of the advantage, disadvantage and adaptability of each: segmental tile arches; reinforced concrete joists with hollow clay tile fillers; reinforced concrete joists with gypsum tile fillers; and, flat slab types of construction. Although each building has so many variables in building construction that it is difficult to give definite rules to select immediately the best type of construction, yet with the type of foundation, spacing of columns, clear story heights, live loads and the use of the building detd., the kinds of fireproof construction which should be investigated will be reduced to a very small number. C. W. O.

Analysis of cost of types of fireproof construction. Arthur F. Klein. *Jour. W. Soc. Engrs.*, **29** [5], 290–300(1924).—Average costs are given for: (1) a 16-story hotel building, where 4 types of construction are considered, including a steel and hollow tile construction; (2) a light mfg. building, discussing 3 types of construction; and (3) a warehouse, giving cost data on 3 types of construction. The paper deals with the advantages on a purely cost basis and not from a consideration of the best type of construction. C. W. O.

The First World Power Conference, representing 30 countries was held at the British Empire Exhibition, London on June 30–July 12th. It discussed the potential resources of hydroelectric power, oil and minerals in each country, and the generation and utilization of power. H. H. S.

The Internat. Union of Pure and Applied Chemistry, held its annual meeting at

Copenhagen, June 26–July 1. The meeting next year will be at Bucharest, Roumania (*J. S. C. I.*, **43,** 718–19(1924)). H. H. S.

Powdered-coal firing for water-tube boilers and metallurgical furnaces. H. W. HOLLANDS. *Proc. Inst. Mech. Eng.*, **1923,** 1143–51.—The two chief systems in use are: (*a*) the central system (favored in America) and (*b*) the unit system (important in France and England). In (*a*) the fuel is delivered from a central storage bin by cyclone fans. Resulting disadvantages are: (1) high first cost due to grinder, air-separator, screw-conveyor, cycle fans, bins, driers, etc.; (2) size of the plant; (3) danger of explosion of stored powd. coal. In the unit system each boiler or furnace has a pulverizer. This is said to result in low first cost, smaller space, no risk of explosion, and in case of break-down, only one furnace is affected. Machines of the grinding or crushing type must have coal with a moisture content down to 1%. The machine described can take coal with 8% moisture. Excessive moisture is removed by hot air from the combustion chamber. Power required for operation with 460, 1100, 2700 lbs. coal per hr. is 7.3, 14, 37 h. p., respectively. About 2% of the power developed is used by the pulverizer. Excessively fine crushing results in lowered efficiency. A gravity pocket avoids the use of a magnetic separator. In practice, too high velocity of the coal causes scouring of the brickwork. CO_2 should be kept at 16% or over. The C content of the ash should usually be under 1% and never over 2%. Coal was used successfully with an ash content of 43.7%. Powd. coal is considered as flexible in use as oil or gas. Actual repairs usually come to about 1.5 d. per ton of fuel burnt. Much additional data are tabulated and charted. C. G. K. (*C. A.*)

BOOKS

Reference List of Bibliographies: Chemistry, Chemical Technology and Chemical Engineering Published since 1900. Compiled by Julian A. Sohon and W. L. Schaaf. New York: H. W. Wilson Co. 100 pp. $1.50. Reviewed in *Ind. Eng. Chem.*, **16,** 543(1924). (*C. A.*)

HAINBACH, RUDOLPH: **Pottery Decorating.** New York: D. Van Nostrand Co. 2nd ed., revised. 256 pp. $3.00. (*C. A.*)

BOOK REVIEW

English Pottery. Its Development from Early Times to the End of the Eighteenth Century. By BERNARD RACKHAM and HERBERT READ. With an Appendix on the Wrotham Potters by DR. J. W. L. GLAISHER. Illustrated. 141 pp. and 115 plates. New York. Charles Scribner's Sons. $30.

A beautiful, large-paper book, handsomely printed and made and illustrated with rare beauty. The authors, both of whom are members of the staff of the Victoria and Albert Museum and authorities of high standing on this subject, have made a real contribution historically and critically to the story of the birth and early growth of artistic handicraft in the first of the English-speaking nations. They go back to the very earliest relics of the potter's art in England, in the twelfth century, and

Plate, inscribed "The rose is red, the leaves are green. God save Elizabeth, Our Queen." Dated 1602.

follow its development through 600 years, until the beginning of the industrial era and machine-made wares. Throughout they treat the subject from a critical viewpoint, revealing the development of taste and skill, tracing influences from within and without the country and endeavoring to establish artistic standards for the appraisal of early ceramic products.

The basic principles of criticism which they apply to these early native wares are these: That when the intention is utilitarian any departure from utilitarian form weakens the esthetic appeal; that there must by symmetry of form or some more subtle balance; that to be really good a vessel must possess a certain vitality growing out of its lines and masses and their ability to suggest "movement, rhythm, or harmony, which" they add, "may indeed be the prime cause of esthetic pleasure;" that in its decoration the vessel, whatever its form, should be treated as blank panel and decorated appropriately.

Dish, red earthernware, decorated in white slip under a yellowish glaze. Staffordshire, second half of seventeenth century.

Dish, red earthernware, covered with a dark brown slip and decorated in white and olive, with the subject of the fall. About 1670.

The great Danish authority, Dr. Emil Hanover introduced his survey of English wares with the statement that "English pottery is, at the height of its development, certainly English—from the point of view of material an original and national product—but a product much more of industrial enterprise than of industrial art."* * * Such criticisms as these are hardly just to what some will reckon to be the purest, if not always the most beautiful, work of the English potter. They take too little account of the nature of pottery and of the technique natural to the material of which it is made. Like most other arts, that of the potter had a humble birth in meeting purely utilitarian needs, but from the first it was potentially, no less than painting or sculpture, a means of esthetic self-expression through the work of the hands.

When the Anglo-Saxons came they brought with them the rudiments of the potter's art and to these the Roman occupation added the use of the potter's wheel and some primitive kind of kiln.

The chapter devoted to the Middle Ages and the Tudor times follows the development of pottery through those centuries, with descriptions of many pieces in museums and collections. Next the authors take up the English tradition in English pottery, study the influences from other countries and from within England itself that shaped its development, describe methods and the work of the chief potters through the seventeenth century. After a survey in a long chapter of the influence of foreign work, especially

majolica and delft, the authors arrive at the age of industrialism, which they study at some length, devoting a final chapter to Wedgwood and the Neo-Classical Age. It is the conviction of these authors that English art of all kinds, including that of the potter, has shown a remarkably individual character as compared with that of the Continent. They find no lasting extraneous influence on English pottery until toward the end of Elizabeth's reign, when tin enamel, the distinctive characteristic of majolica, faience and delft, was introduced. At about the same period came from Germany the method of making the semi-vitrified pottery called stoneware. The discussion and description of these two influences and of individual examples of wares produced is full and rather elaborate.

Punch bowl, enameled earthenware, painted in blue, with Chinese landscapes. Inside the Arms of the City of Liverpool and the inscription "Thomas Bootle, Esquire, member of Parliament for Liverpoole, 1724."

The estimate of Josiah Wedgwood's work and of his influence on the art of pottery in England is notable for the fullness of knowledge on which it is based, its high critical standard and its eminently fair and judicial spirit. The authors say that he "is indisputably the outstanding figure in the history of English pottery," and they consider it "only an accident of time" that his name is always associated with the introduction of classical models. The classical revival was the result of the great archaeological discoveries in the latter part of the eighteenth century, and Wedgwood's mind, they say, was of that inquiring and enterprising stamp which made it inevitable that he should seize upon the possibilities of popular appeal in classical figures and scenes. And he had that gift for organization and for procuring efficiency in production that makes the modern captain of industry. "Wedgwood was the first English potter," say the authors, "to employ the energies of a large part of his factory staff as a regular thing in the making of vases solely for ornament; at the same time he first gave serious attention to increasing the efficiency of his useful articles from a purely utilitarian point of view. To this end he made division of labor and standardization a condition of commercial success in the pottery industry not only of Staffordshire and England, but of the whole world."

The illustrations comprise 207 figures reproduced in 115 page plates, of which twelve are in color. The pottery examples which they picture are treasured pieces in British museums and collections and the wide extent of the studies and knowledge of the authors is indicated by the fact that they have found these pieces in more than a dozen different museums and over twoscore private collections. They illustrate the development of British pottery down through the centuries from the fourteenth to the eighteenth. Many of them are of great beauty and all of them are examples of the reproductive art at its artistic best.

The New York Times, "Book Review," July 20, 1924.

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CERAMIC ABSTRACTS

Compiled by the

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Ross C. Purdy, Editor
Emily C. Van Schoick, Asst. Editor

Abstractors: Olaf Andersen, Robert J. Anderson, A. A. Ayars, C. E. Bales, E. N. Bunting, W. M Clark, S. S. Cole, R. R. Danielson, F. C. Flint, H. D. Foster, A. F. Gorton, Perry D. Helser, C. J. Hudson, W. R. Kerr, P W. Ketchum, S. Kondo, H. F. Kriege, B. M. Larsen, R. D. Leitch, J. T. Littleton, Jr., M. E. Manson, T. N. McVay, R. J. Montgomery, Louis Navias, O. P. R. Ogilvie, C W. Owings, C. W. Parmelee, J. G. Phillips, W. E. Rice, E. Schramm, H. G. Schurecht, D. E. Sharp, H. F. Staley, H. H. Stephenson, F. A. Whitaker.

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[1] The abbreviation (*C. A.*) at the end of an abstract indicates that the abstract was secured from the editor of *Chemical Abstracts* by coöperative agreement.

Abrasives

Tentative definitions of terms relating to the gypsum industry. ANON. *Proc. A. S. T. M.*, **23** [1], 642–3(1923). E. N. B.

Report of Committee C-11 on gypsum. W. E. EMLEY, *et al.* *Proc. A. S. T. M.*, **23** [1], 231–5(1923).—The amendments recommended to the tentative methods of testing gypsum and gypsum products are listed. Three papers on gypsum are added as appendices. E. N. B.

Volumetric changes of gypsum. J. M. PORTER. *Proc. A. S. T. M.*, **23** [1], 244–53(1923).—The expansion and contraction of various gypsum-sand mixes were exptly. detd. and are displayed in several graphs. It is concluded that the lack of adhesion of a gypsum sand mix on a concrete base is due to a difference in the expansion of the two and not due to chem. reaction between the cement and gypsum. E. N. B.

The fire resistive properties of gypsum. S. H. INGBERG. *Proc. A. S. T. M.*, **23** [1], 254–6(1923).—The vol. changes taking place in gypsum when it is htd. are reviewed and the properties of gypsum as a fire protective covering for columns are discussed. E. N. B.

Report of Committee C-3 on brick. T. R. LAWSON, *et al.* *Proc. A. S. T. M.*, **23** [1], 194–5(1923).—Six types and sizes of paving brick are recognized as standard. No specif. on concrete brick are given, since further exptl. data on their properties are needed. It is recommended that more study be made of the condition of brick, after yrs. of service, obtained from demolished bldgs. E. N. B.

Report of Committee C-4 on clay and cement sewer pipe. R. HERING, *et al.* *Proc. A. S. T. M.*, **23** [1], 196–7(1923).—The subjects receiving the considerations of the sub-committee, and recommendations regarding specif. are given. E. N. B.

Report of Committee C-6 on drain tile. A. MARSTON, *et al.* *Proc. A. S. T. M.*, **23** [1], 198–207(1923).—Abstracts are given of field and lab. tests on drain tile carried out by (1) Iowa Eng. Expt. Sta., (2) Structural Mats. Research Lab. of Lewis Institute, (3) U. S. Bur. of Public Roads, and (4) Engineering Inst. of Canada. The changes recommended in the Standard Specif. for Drain Tile (C-4 (1921)) are also listed. E. N. B.

Report of Committee C-7 on lime. H. C. BERRY, *et al.* *Proc. A. S. T. M.*, **23** [1], 208–13(1923).—The repts. of the 7 sub-committees contg. recommended revisions of specif. are given. E. N. B.

Tentative specifications for hydrated lime for structural purposes. ANON. *Proc. A. S. T. M.*, **23** [1], 620–5(1923).—The requirements cover chem. properties, fineness, const. of vol., tensile strength and plasticity. The methods used in making these tests are described. E. N. B.

Tentative specifications for concrete aggregates. ANON. *Proc. A. S. T. M.*, **23** [1], 626–8(1923).—Requirements are given covering the quality, grading and strength in concrete for both fine and coarse aggregate. E. N. B.

Tentative specifications for gypsum. ANON. *Proc. A. S. T. M.*, **23** [1], 629–31 (1923).—Covers (1) mats. and standards, (2) sampling, (3) packing and marking, (4) inspection and rejection. E. N. B.

Tentative specifications for gypsum partition tile or block. ANON. *Proc. A. S. T. M.*, **23** [1], 632–5(1923).—Covers requirements for compn., dimensions, strength, sampling and inspection. E. N. B.

Tentative methods of sampling, inspection, packing and marking of quicklime and lime products. ANON. *Proc. A. S. T. M.*, **23** [1], 636–9(1923). E. N. B.

Hydraulic and puzzolanic cement from volcanic ash and clay-shale of western India. K. A. KNIGHT HALLOWES. *Trans. Min. and Geol. Inst. of India*, **18**, 72–5

(1924).—Results given of exptl. research in the lab. of Geol. Surv. of India. A table shows results obtained from 25 samples. It shows that it is possible to make puzzolanic cements of low tensile strength from the mats. available by mixing the volcanic ash of the island with the lime which has been locally manufd. O. P. R. O.

Cements with high aluminium content. M. J. Bill. *J. four. elec.*, **32,** 13(1923); *J. Inst. Metals*, **30,** 703.—Cements are characterized by slow setting and rapid hardening. By raising the Al content in ordinary lime cement products of the following formulas are obtained: $Al_2O_3.3CaO$, $3Al_2O_3.5CaO$, $Al_2O_3.CaO$, $Al_2O_3.3CaO$. The first two are of no com. use, the last two are useful; they are obtained by fusion in elec. furnace at 1350° to 1500°. Compn. may vary from 5 to 15% SiO_2, 35 to 45% Al_2O_3, 35 to 40% CaO. They are highly resistant to salt water and solns. contg. sulfates. They harden in 7 to 8 hrs. C. L. M. (*C. A.*)

Water-solubility and hydration of the calcium aluminates. Hans Kuhl and Heinrich Thüring. *Zement*, **13,** 109–11, 243–6(1924).—The set of Ca aluminates is the crystn. from the H_2O phase as in plaster of Paris. The soly. is about that of $Ca(OH)_2$. Mixes of pure powd. CaO and Al_2O_3 in mol. ratios of 1–1, 3–1, and 5–3 are made into balls and melted from the top with an oxy-acetylene flame, the unmelted shell holding the melt. Pure cryst. subs. result. Digestion of 0.3 g. in 100 cc. H_2O at 20° for 24–192 hrs. in pure H_2O, weak and concd. solns. of $Ca(OH)_2$ follows. The solns. become turbid after a few hrs.' contact, because of colloid formation. The filtrates are examd. for Ca and Al in the usual way. The three aluminates studied are sol. in H_2O, with decreasing soly. in increasing concn. of lime solns. The dissolved aluminates react with lime solns. producing $Al(OH)_3$ and hydrous Ca aluminate. The $Al(OH)_3$ formed by hydrolysis shows as a gel in a few hrs. Microscopic examn. reveals many hexagonal crystals of Ca hydroaluminates forming in solns. poor in Ca. This salt is quite sol., shows weak hydrolysis and contains probably 3 or less CaO to $1Al_2O_3$. Small octagonal crystals also appeared in rich CaO mediums, having low soly., strong hydrolysis and consisting probably 4 mol. CaO to $1Al_2O_3$. The reaction products depend on the total concn. of reacting subs. and not on the type of original aluminate. H. F. K. (*C. A.*)

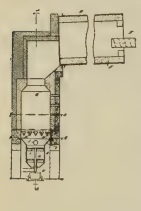
Determination of the hardness of abrasives. W. Mindt. *Werkstattstechnik*, **17,** No. 12, 360–7(1923); *Physik. Ber.*, **4,** 1092–3.—For uniform feeding of abrasive the grinding action is proportional to the time. The amt. of grinding per unit time, a, depends on the rate of feeding of the abrasive; it rises to a max. and then decreases. The length of life of the material is ascertained by measg. the amt. of substance which it is grinding off in different periods of time. If the amt. of grinding accomplished at time t is designated by A, and the speed of grinding da/dt is put proportional to the

Material	$G.10^3$	$c.10^5$	$Gc.10^6$	H_1	H_2	H_3	H_4	E
Quartz sand	42	64	27	308	175	7.0	...	10,300
Corundum (Norton)	142	107	152	1150	1000	9.0	...	....
Corundum (Dynamidon)	113	139	157	1150	1000	9.0	...	....
Corundum (emery)	142	114	162	1150	1000	9.0	...	....
Tungsten carbide	163	106	168	....	....	9.8	...	....
"Novo-diamond"	163	106	168	1150	1000	9.0	...	....
Corubin	127	193	246	1150	1000	9.0	...	....
Corundum	142	200	234	1150	1000	9.0	...	....
Volomit 21	234	138	310	....	....	...	120	1765
Si carbide	212	229	485	....	....	9.8	...	....
Diamond	∞	...	495	....	140,000	10.0	...	....
Volomit 13	296	194	575	....	....	...	...	....

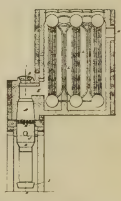
grinding power $A-a$, then $a = A(1-e^{-ct})$, where c is a proportionality factor. Since the total grinding work is proportional to the square root of the quantity of abrasive applied, S, $A = G\sqrt{S}$, where G is the sp. total grinding work per unit quantity of abrasive. For similar material this grinding power is independent of the size of particle. Apparently the grinding power increases with pressure applied to a limiting value, and then rapidly falls off. The relation between grinding speed, grinding surface, and hardness of the comparison material should be considered. As a measure of hardness either the value G or c would serve, though it is expedient to replace c by Gc, the initial grinding speed per unit quantity. The table gives a résumé of exptl. results. H_1, H_2, H_3 and H_4 denote hardness after Auerbach, Rosiwal, Moss and Martens, resp., and E denotes modulus of elasticity. A. E. S. (*C. A.*)

PATENTS

Process and apparatus for making cement. SPENCER B. NEWBERRY. U. S. 1,504,701, Aug. 12, 1924. In a device of the class described the combination of a vertical kiln having an outlet at the top and a movable grate at the bottom to support the mass in the kiln and regulate and control the discharge of clinker through it, a pipe for supplying air under press. to the space below the grate, a substantially air-tight closure below said grate of funnel shape with a central discharge extension, a pair of spaced valves in said extension and means for feeding mat. contg. carbonaceous combustible matter to said kiln at the top.



Process for burning cement clinkers. SPENCER B. NEWBERRY. U. S. 1,504,702, Aug. 12, 1924. The process of producing cement clinker comprising forming small coherent masses of cement raw mat. and carbonaceous fuel, the constituents of which are so proportioned that the argillaceous matter will be less than that required by an amt. which will be replaced by the ash produced when the combustible constituents are burned, supplying said masses to the upper surface of a laterally enclosed and heat insulated body of predetd. height composed of similar masses, forcing a strong blast of air upwardly through said body to support and cause the combustion of the combustible constituents, and discharging the cement clinker thereby produced at the bottom, agitating the body of mat. during the passage of air for combustion and disintegrating coherent masses of clinker as they are discharged.



Magnesite cement. B. BAKEWELL. Brit. 214,369, Feb. 6, 1923. A cement which does not corrode Fe is made by adding $FeCl_2$ 30 parts (calcd. as cryst. chloride) to 100 parts of magnesia. Fillers such as asbestos, sand or cork may be added but fillers are to be preferred which do not absorb H_2O to any great extent as excess of H_2O destroys the non-corrosive character of the cement. The H_2O should not exceed 70% of the MgO. (*C. A.*)

Art

Clay figures of palaeolithic age. ANON. *Nature*, **113**, 506(1924).—The discovery has recently been made by M. Norbert Casteret of some remarkable examples of palaeolithic art in the vicinity of Saint-Martory (Haute Garonne). In a cavern were found not only rock carvings of animals and a human head, but some clay models in the round and in bas-relief. Geol. evidence indicates that these figures date back to a cold and very dry period when the parts of the cavern now filled with water from a subterranean stream were readily accessible. The find is notable in that the only previous discovery of a like nature is that made by M. le Comte Begouen at the Tuc d'Audoubert in 1912. O. P. R. O.

Cement, Lime and Plaster

Getting rid of efflorescence on gypsum plaster. E. C. WELCH. *Chem. Met. Eng.*, **31**, 263–4(1924).—Efflorescence is due to sol. salts in the mixing water, sand, or calcined mat. Fairly insol. compd. such as gypsum may be deposited as efflorescence if water percolates through the mat. continuously, or if water is condensed and evapd. on the surface of the mat. repeatedly. Lime added to the plaster or used in the finish coat usually prevents efflorescence. Addition of $^1/_2$% of dextrine or gum arabic to the mixing water reduces efflorescence on casts considerably. M. E. M.

What is good magnesium oxychloride cement? H. L. OLIN AND B. H. PETERSON. *Chem. Met. Eng.*, **31**, 266–7(1924).—The effects of additions of various mat. to magnesium oxychloride cement were noted. 120-mesh calcium carbonate had no effect up to 6%. Iron and aluminum oxides up to 4% had no effect. Calcium oxide lowered the tensile strength in direct propn. to the per cent present. The last mat. has no effect on the temp.-vol. change, but lowers the tensile strength by increasing the setting shrinkage. Addition of 6% free lime increased the setting shrinkage ten-fold. M. E. M.

Silicate of soda and concrete. ANON. *Chem. Age*, **9**, 118(1924).—Na_2SiO_3 is being used as a wash for concrete in ratio of 1:4 of H_2O. Gives a hard surface resisting abrasion on road work. Eliminates growth of fungus on sewage tank walls and reduces the permeation of H_2O. S. S. C.

Bricks from blast furnace slag. ANON. *Chem. Age*, **9**, 11(1924).—Slag mixed with 6–10% of $Ca(OH)_2$ which must be completely slaked. Special hydrater used to give ample opportunity for mixing of CaO and H_2O. Slag and lime mixed in edge roller mill. Molded under 4000 lb. press. per sq. in. Heated 5–6 hr. in steam at 212°F. Crushing strength of brick 4800 lb. per sq. in. S. S. C.

Thermo-chemistry of Portland cement burning. M. DAUTREBANDE. *Quarry & Surveyors' & Contractors' Jour.*, **29**, 218(1924); *Chaleur et Indus.*—The thermic reactions produced during burning process of the mat. of artificial Port. cement are complex, and if some are well detd. others are still open to conjecture. D. concludes that artificial Port. cement is produced from ground clinker or rock obtained by burning to

TABLE I

	Clay		Schist	
	1	2	1	2
Loss by heat	11.90	10.90	7.25	8.80
SiO_2	54.00	59.80	58.40	53.90
Al_2O_3	16.00	14.11	16.39	20.40
Fe_2O_3	5.50	4.10	9.11	8.10
CaO	9.50	7.80	4.22	5.10
MgO	...	1.20	2.05	1.35
SO_3	...	...	2.01	1.44

TABLE II

	Limestones		Clayey limestones	
	1	2	1	2
Loss by heat	42.61	39.20	...	...
SiO_2	0.64	5.80	30.60	22.15
Al_2O_3 / Fe_2O_3	1.825	3.55	12.50	9.00
CaO	55.30	52.10	31.54	37.92
MgO	0.47	traces	0.80	1.10
SO_3	traces	...	0.30	0.20

vitrification point of a thoroughly and finely ground mixt. of carbonate of lime in the form of chalk marl or limestone, and of clay or schist, and gives the preceding analytical tables of the component parts of the mixt. after burning.

During the burning process the following reactions take place: (1) Elimination of water; (2) decompn. of the carbonate of lime into carbonic acid and lime $CO_2CO = CO_2 + CaO$; (3) decompn. of carbonate of magnesia into carbonic acid and magnesia, $CO_3Mg = CO_2 + MgO$; (4) combination of the silica with the lime to form silicates of lime; (5) combination of the alumina with the lime to form aluminates of lime; (6) oxidation of iron protoxide; (7) combustion of organic matter and of sulphur of sulphurets, while certain sulphates are not decomposed at burning temp.; (8) volatilization of alkaline salts.

TABLE III

	1	2	3
Loss by heat	0.50	1.00	0.84
SiO_2	22.91	22.00	26.36
Al_2O_3	6.75	9.50	7.82
Fe_2O_3	3.00		2.18
CaO	64.34	65.25	64.50
MgO	2.00	1.08	0.21
SO_3	0.50	2.04	1.35

Of the several reactions and combinations induced by the burning process, some (the endothermic) absorb heat, while others (the exothermic) liberate ht. The endothermic reactions are: (1) Decompn. of carbonate of lime into carbonic acid and lime which requires 436 cal. per kg. of carbonate of lime; (2) decompn. of carbonate of magnesia into carbonic acid and magnesia requiring 213 cal. per kg. of the carbonate; and (3) elimination of water. The exothermic reactions are: (1) Combustion of organic matter, carbon giving 8080 cal., and (2) combustion of sulphur which, in transforming to SO_3, gives 2250 cal. As regards the combination of silica and alumina with lime, these, according to Berthelot, would give 591 cal. per kg. of lime, or 331 cal. per kg. of carbonate of lime (1 kg. of CO_3Ca containing 0.56 of quicklime). These combinations may be exothermic, as shown by calc., which work out with too low a value for reactions to add anything to ht. augmentation. M. Hendricks considers these reactions as exothermic but, though liberating a considerable quantity of ht., they are incapable of raising the temp. of the burning mass in reaction, because their ht. is utilized in counterbalancing another endothermic reaction produced at the same time, *viz.*, the dissolution of the alite (a silicate of calcium). As to firing temp., the firing of the clinker-producing mat. results not in fusion but rather in a vitrification marked by elimination of vol. and augmentation of d. in the mass. Various factors influencing temp. are: (1) homogeneity of aggregate, fineness of grinding and wetness, and (2) chem. compn. In one dry process a higher figure than 15% of water has facilitated burning, while, with a very dry meal, combination is retarded and a start in burning appears to be slow and difficult. As to chem. compn., the melting of iron oxide and alumina may be considered to facilitate burning, while a high percentage of lime renders this operation more difficult. The form of the silica used has also a great effect, as sol. it combines more easily and at a lower temp. than it does in an amorphous or quartzose state. It can be assumed that at 900°C carbonic acid is completely expelled and that certain reactions between the silica and the iron oxides and the alumina are beginning, and that burning will be finished at about 1550°C. For a meal leaving 23.6% on a 200 per cu. cm. mesh sieve, the burning temp. necessary is above 1612°, while for the same mixt., but ground so as to leave only 2% on the same sieve, it requires a temp. of 1475°C. For a 62.64% of lime in the clinker, firing temp. was 1549°, while for 63.83%

it was 1593°, and for 62.12%, 1625°. Waste gases from furnaces range from 300° to 600°C., depending upon the burning process installed, and also on the length of the fur. These gases have been utilized for various purposes, such as drying of paste, htg. of boilers, and preliminary firing or calcination of mat. in sep. fur. In a fur. 20 m. long and 2 m. in diam., it is calcd. that there is a loss of 72° of the total ht., though this amt. has been reduced to 36%. The gases of one fur. 50 m. long and 2.75 m. in diam., used for the wet process, had a temp. of 400°C when issuing, but the loss of ht. through the flues was only 18% of all produced. O. P. R. O.

Lime (S. Africa). T. G. Trevor. *S. African Jour. of Indus.*, **7,** 459(1924).—Three forms of limestone are at present known and worked in S. Africa: (1) Magnesium limestone (common dolomite), which covers vast areas in the Transvaal and Cape Provinces; (2) white lime deposits have been inadequate to meet the demand for chem. and metallurgical purposes, but an extensive deposit of pure white limestone, said to contain not less than 7,000,000 T., is now being opened up at Taung, Bechuanaland; and (3) desert limestone covers vast areas in all the Provinces, but it contains 20% silica and other impurities. It is used for cement making, for other purposes it does not generally yield a good lime. O. P. R. O.

The dehydration of gypsum. P. Jolibois and P. Lefebre. *Oil and Color Trades Jour.*, **66,** 684(1924).—When the temp. does not exceed 160°C, the loss of water corresponds to the formation of a semi-hydrate. A complete dehydration can be effected rapidly at 200°. These observations explain why plaster taken out of the ovens or fur. is a mixt. of anhydrous sulphate of lime and semi-hydrate. It is well known that if the temp. exceeds 300° the plaster obtained will no longer set with water. (*Rev. de Chim. Ind.*) See *Ceram. Abs.*, **2** [10], 214(1924). O. P. R. O.

A hundred years of Portland cement. K. Goslich. *Zeitschrift für Angewandte Chemie,* **37,** 265, 297, 504(1924).—A history of the growth of the Portland cement indus. in Germany outlining the development of the various processes to the present time. O. P. R. O.

Portland cement of high basicity. Fabio Ferrari. *Atti congresso naz. chim. pura applicata,* **1923,** 286–93; cf. *C. A.*, **15,** 2345.—Expts. are described on artificial calcined products to det. the reln. between the hydraulic properties and (1) the compn. and nature of the generating mixt.; (2) the fineness of grinding and homogeneity of the resulting mixt.; (3) the temp. of firing; (4) the rate of cooling and (5) the fineness of grinding of the cement. The mixts. were prepd. by a method already described (cf. Ferrari, *Le industrie costruttive,* **20,** No. 1, 1923). The best products in 2 series of tests had the following properties: $CaO/(SiO_2 + Al_2O_3 + Fe_2O_3)$ ratio 2.23, 2.27; $SiO_2/(Al_2O_3 + Fe_2O_3)$ ratio 2.97, 3.25; Al_2O_3/Fe_2O_3 ratio 1.55, 0.65; d. 3.06, 3.03; initial set 2.25, 3.33 hrs.; final set 4.08, 5.5 hrs.; expansion (Le Chatelier) 0, 0; resistance to compression in kg. per cm^2. after 3 days in H_2O 253.4, 235.7; after 7 days in H_2O 235.7, 369.0; after 28 days in H_2O 574.7, 667.5; after 28 days in air 601.9, 632.2.

C. C. D. (*C. A.*)

Action of calcium chloride and calcium sulfate on the setting and hardening of Portland cement. Fabio Ferrari. *Atti congresso naz. chim. pura applicata,* **1923,** 294–7; cf. Candlot, *Chaux et Ciments,* Paris, **1908.**—In view of the fact that CaO is a normal component of Portland cement (cf. *C. A.*, **15,** 2345), that it plays an essential part in the setting and hardening, and furthermore that its action has not been satisfactorily explained, expts. were made to det. the action of $CaCl_2$ and gypsum during the *setting and hardening of a mixt. of CaO and SiO_2.* A mixt. of CaO and quartz (20:80) ground to the ordinary fineness of cement set in 10 min. when made into a paste with H_2O alone. The same mixt. with 2–3% $CaCl_2$-soln. set in approx. 9 hrs., a result in accordance with the fact that CaO becomes hydrated with extreme rapidity in the

presence of $CaCl_2$ and that $Ca(OH)_2$ is almost insol. and crystallizes very slowly. With 30% $CaCl_2$ soln. however the paste set in 5 min. and became extremely hard in a short time, due to the formation of an oxychloride (cf. Le Chatelier, *Recherches expérimentales sur la constitution des mortiers hydrauliques*, Paris, **1904**). A mixt. contg. 19.6% CaO, 78% quartz and 2% gypsum set in approx. 4 hrs. with H_2O alone, with noticeable hardening. When a const. wt. of a mixt. of CaO and gypsum in varying proportions was agitated with H_2O, the max. rise in temp. increased with the amt. of gypsum. Unlike the ordinary product obtained with CaO and H_2O, the products even with a low amt. of $CaSO_4$ were composed of minute hard granules. The expts. indicate in general that setting is retarded by gypsum and small amts. of $CaCl_2$ (cf. *C. A.*, **16**, 2586, 4318) but is accelerated by a large amt. of $CaCl_2$. C. C. D. (*C. A.*)

Portland cement silicic acid. F. Hart. *Zement*, **12**, 300–1(1923).—Three Port. cements were very finely ground, treated with HCl, and the silica which sepd. later was washed and then exposed to air at a definite temp. and of definite humidity until const. in weight. The relative propns. of water and silica in the product at various intervals were detd. and the results plotted on a compn.-time chart. The water content decreased regularly for 11 days, but then the curve showed a sudden change of direction and the water content subsequently remained practically const. The point at which the change occurred corresponded to a compd. contg. 62.78% of silica and 37.22% of water, *i. e.*, to an orthosilicic acid, with each of the cements examd.

B. C. A. (*C. A.*)

Development of hydraulic properties in granulated blast-furnace slags. H. Kuhl. *Zement*, **12**, 320–2(1923).—Apparently small differences in slags may cause great differences in the nature of the resulting cement. Some blast-furnace slags—particularly those rich in alumina—produce excellent cements when ground with a large percentage of $CaSO_4$, with or without a suitable "developer of hydraulicity" such as lime or Port. cement clinker. The addn. of 1% of lime is useless. When 3–5% of lime is used, the mixt. remains "dead" for some days and then suddenly develops a high strength. Port. cement when added to a slag behaves in a similar manner to lime, but the final product is not so strong, 30% of cement clinker having a similar effect to 8% of lime. When $CaSO_4$ alone is added, at least 12% is required to produce a mixt. having a satisfactory crushing strength after 28 days. The best results, so far as tensile and crushing strengths are concerned, were obtained with a slag from cast iron, with a mixt. of 86% of slag, 8% of lime, and 3–9% of $CaSO_4$. A mixt. of 70% of slag, 30% of cement clinker, and 2–10% of $CaSO_4$ gives similar results. B. C. A. (*C. A.*)

Influence of the chemical composition of slags and Portland cements on the hardening of blast-furnace cement and on its resistance to sulfates. R. Grün. *Zement*, **12**, 297–8, 307–10, 317–9, 326–9(1923).—Several Port. cements and blast-furnace slags and mixts. of these in various proportions were examd. and it was found that with each slag also there was 1 Port. cement which gave better results than the others; the ore cement was as good as any of the Port. cements. In blast-furnace cements the slag acts as a carrier of the hardening agent and is the source of strength; the influence of the Port. cement is much less than that of the slag. The influence of the Port. cement on the resistance of a blast-furnace cement to sulfate solutions is low, but is greater than its influence on the crushing strength. All the mixts. gave better results than any of the sep. materials. The slags least resistant to sulfate solns. were those lowest in silica and high in alumina or Mn. The mixts. contg. Port. cement with less than 63% of lime and these with the ore cement were the most resistant to sulfates; these were also low in alumina. B. C. A. (*C. A.*)

Influence of the chemical composition of slags and clinker on the hardening of blast-furnace cements and on their resistance to sulfates. Haegermann. *Zement*,

13, 2–3(1924).—A criticism of Grün's paper (cf. above) dealing chiefly with questions of priority and also pointing out that as the Port. cements used by Grün were of poor quality his results must be accepted with caution. B. C. A. (*C. A.*)

Influence of sugar and similar substances on the setting and hardening of cement and cement-mortars. Burchartz and von Wrochem. *Zement,* **13,** 11–3(1924).—The use of a 0.1% soln. of sugar instead of water when mixing cement slightly increases the strength, but if a 0.25 or 0.5% soln. is used, the strength is diminished and the test-pieces crack in water. When a 1% soln. is used the cement has a low strength at 7 days, but an abnormally high one at 28 days. A 1:3 cement sand mortar behaved similarly, but great strength at 28 days was not developed. When glucose or tannic acid was substituted for sugar, a similar loss in strength occurred. When samples of cement mortar were immersed in a 1% soln. of sugar for 28 days no change occurred in their strength. Microscopical examn. showed that sugar and similar substances hinder the formation of crystals in cement-mortar and also hinder the swelling of the cement particles. This power of sugar and similar substances to reduce the strength of cement mortars suggests that when a cement is found, in use, to give low results a search should be made for org. substances in it, in addn. to making the usual tests. B. C. A. (*C. A.*)

Enamel

Interchangeable air system reduces operating cost in enameling plant. Anon. *Cer. Ind.,* **3** [2], 99–102(1924).—Rept. of visit to The Vitrified Iron Products Co. of Clyde, Ohio. Cast iron and sheet steel porcelain enamel ware are manufd. The cast iron pieces are kept in a drier until enameled, after being sand blasted. The sheet steel is left in the cleaning tank for from 7 to 10 mins. and is pickled for about 7 mins. The baths are kept near the b. p. with open steam jets. The smelter has a capacity of smelting 800 lbs. of raw material in 2 hrs. The recuperation principle is very effectively employed, the primary air being preheated to 700°F. Low press. air and high pressure oil are used in the burners. The hearth of the smelter is built in the form of the letter "V" with a slope of about 20° from the back wall to the tap hole. An interchangeable air compressor and fan arrangement permits continuous operation throughout the plant. The driers are gas heated and equipped with canvas doors. The furs. are oil-fired and equipped with 3 recuperators. A uniform temp. is insured throughout the length of the fur. by having the openings to the recuperator chambers at the front of the fur. The 8-in. oil burners operate on 60 lbs. oil pressure and 12 ozs. air press. From 8 to 9 gals. of oil are required per hr. to fire from 400 to 600 sq. ft. of sheet steel or over 400 lbs. of cast iron. The sheet steel ground coat is fired at between 1650 and 1675°F and the cover coat at between 1625 and 1640°F. The cast iron enamel is fired at between 1350 and 1400°F. The temp. is measured with pyrometers and the time with sand clocks. P. D. H.

The use of antimony in the enamel industry. B. Rewald. *Chem.-Ztg.,* **48,** 280(1924).—While SnO_2 is the most commonly used opacifier, Sb has lately gained wider recognition. In many countries the use of Sb in technical enamels is forbidden on account of the danger to health. But if the Sb is properly fritted there is no danger and its use should not be forbidden. C. H. K. (*C. A.*)

Enamel apparatus and its use. Wenz. *Chem. App.,* **11,** 89(1924). J. H. M.

Glass

Tremendous strides made by plate glass industry in last decade. Anon. *Cer. Ind.,* **3** [2], 95–8(1924).—One of the most costly items in the manuf. of plate glass has been glass pots. An average of 12 melts per pot is considered a good record. In most

branches of the glass indus., the continuous tank fur. has replaced the pot fur. A plant is thus enabled to operate continuously and at a lower cost than with the pot fur. While fuel is an important item, the principal expense of glass making has been the labor cost. Modern machinery, however, is gradually replacing hand labor. The automobile indus. requires 50% of the annual plate glass output. There are tables giving the production of bldg. glass in the U. S. and the exports and imports over a period of years. P. D. H.

Glass manufacture (Czechoslovakia). ANON. *Indus. Aust. and Min. Stand.*, **71**, 878(1924).—A history of the glass indus. of Czechoslovakia, which now ranks 2nd largest in Europe. It comprises 160 factories and 3600 small establishments where glassware is cut, engraved, etched, painted or mounted. O. P. R. O.

Electric furnace for glass-making. J. E. PARKER. *So. Af. Jour. Indus.*, **3**, 158–60(1920).—A treatise on the suitability of the elec. fur. for glass-making. The difficulties to be overcome in the design of an elec. fur. suitable for the smelting of the "batch" and "fining" are very minor ones, and a good type of elec. fur. would produce a glass of the purest quality economically and at a min. of loss. The points in favor of the elec. fur. are its increased production and regular uniform good quality glass. The operating costs of such a fur. would show a considerable saving per ton of glass over the existing system. O. P. R. O.

Wood's metal as a seal in vacuum apparatus. LARS A. WELO. *J. Optical Soc. Amer.*, **8**, 453–4(1924).—Wood's metal applied to glass or quartz with a soldering iron molds itself and adheres sufficiently well so that tubes may be joined by soldering the junctions with the same mat. The method is satisfactory for glass or quartz. D. E. S.

Correlation between crack development in glass while conducting electricity and the chemical composition of the glass. EARLE E. SCHUMACHER. *J. Am. Chem. Soc.*, **46**, 1772–7(1924).—Measurements were made at a temp. of 300° of the susceptibility to crack development of 5 different kinds of glasses when conducting electricity, by detg. the no. of times the current could be reversed before the glass cracked. The tendency to crack increases with increasing alkali content and elec. condy. of the glass. Borosilicate glasses showed the least tendency to crack of any of the glasses tested. The anal. of 4 of the glasses are included. D. E. S.

Phosphorescence of fused transparent silica. CHAPMAN AND DAVIES. *Nature*, **113**, 309(1924).—When oxygen or hydrogen is driven into fused quartz by the elec. discharge quartz acquires the property of phosphorescing. This property is probably intimately connected with the absorbed gases. A large quartz tube 100 cm. long and having a diam. of 3.5 cm. was provided with external electrodes of aluminium foil 35 cm. apart. The tube was filled with oxygen (from which mercury and other condensible vapors had been removed by liquid air) at a press. of about 0.035 mm. of mercury. The gas in the quartz tube was submitted to the action of the silent discharge. When the discharge was stopped it was noticed that the tube or its contents were glowing brightly and continued to glow for more than 20 mins. The luminescence was at first thought to be the well-known afterglow of oxygen, but was found to be due to the quartz itself or to the oxygen absorbed near its inner surface because (1) when a small area of the tube is cooled with liquid air while the discharge is passing, that area glows much more brightly than the rest of the tube after the discharge has been stopped; (2) cooling a portion of the tube after the discharge has been stopped has no effect; (3) the sections of the tube which absorb larger quantities of the gas during the discharge phosphoresce more brightly; (4) after the glow has ceased the quartz can again be made to phosphoresce by heating it; but it entirely loses this property when all the absorbed gases have been removed. The phosphorescence caused by heating can be

observed with no apparent diminution in intensity 24 hrs. after the stimulating discharge has been stopped, and the phenomenon is just as pronounced after all the unabsorbed oxygen has been pumped out of the tube. Similar results have been obtained with hydrogen. O. P. R. O.

Coppered glass mirrors. E. A. H. FRENCH. *Nature*, **113**, 806(1924).—Earlier research on this subject was conducted in 1907 by Chattaway, using phenylhydrazine as a reducing agent, but on his findings it was not possible to obtain a coherent copper film on plate glass surfaces. This was probably due to the formation of tarry byproducts, which appear inevitably to result when such a reducing agent is used. Expts. were conducted at the War Department Searchlight Exptl. Establishment with the object of eliminating this drawback. It was found that a satisfactory coherent and lasting film can be deposited on plate glass surfaces at a comparatively low temp. by the use of hydrazine sulphate. The cleaning of the glass surface is peculiarly important. O. P. R. O.

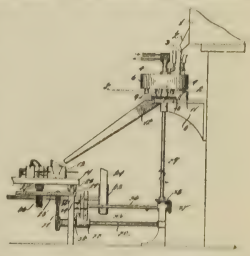
Material handling in a glass works. C. MICHENFELDER. *Zeits. für Angewandte Chemie*, **37**, 488(1924).—A short description of operations from the point of economy and profit. O. P. R. O.

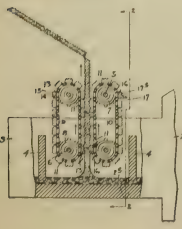
The periodic system of the elements and the mechanical and technological properties of glasses. J. SALPETER. *Z. tech. Physik*, **4**, 36–9(1923).—The oxides of Na and K increase the coeff. of thermal expansion of a glass far more than the oxides of Si, B, and Mg. S. finds a parallel between the at. vols. of the elements and their influence upon the coeff. of expansion of glasses. A similar relationship is indicated between at. vols. of the elements and their influence upon the tensile strength and between at. vols. and compressibility of the glass. L. M. H. (*C. A.*)

Chapman-Stein recuperator. WM. C. BUELL, JR. *Iron and Steel Engineer*, **1**, 327–39(1924).—A recuperator has many advantages over a regenerator. A well illustrated description is given of the Stein recuperator, together with its advantages in design, operation, and economy. L. A. P. (*C. A.*)

PATENTS

Machine for forming glass articles. HENRY M. BROOKFIELD. U. S. 1,505,537, Aug. 19, 1924. In app. for forming articles of glass, in combination with means for feeding molten glass in a continuous unconfined stream, of a distributor for dividing said stream into separate masses to be subsequently delivered to molds, said distributor comprising a horizontally rotatable table provided with a series of vertically walled openings therethrough, means for intermittently rotating said table to bring said openings successively into line with said stream of molten glass, and a stationary shear member adjacent to the stream of glass and to the upper surface of the table and adapted to coöperate with the upper end of each opening to sever the stream of glass and carry it over the intervening table surface to the succeeding opening as the table makes its intermittent movement of rotation.





Method of drawing sheet glass. HUDSON S. CAMPBELL. U. S. 1,505,584, Aug. 19, 1924. The method of forming sheets of glass consisting in drawing the sheet continuously from a bath of molten glass, severing the glass, gripping the succeeding sheet simultaneously with the severing just below the point of severing, and gripping the side edges of the sheet at intervals to keep the sheet taut, all while in a plastic condition.

Glass pot furnaces, etc. M. W. TRAVERS, F. W. CLARK and TRAVERS AND CLARK, LTD. Brit. 213,999, Jan. 15, 1923. (*C. A.*)

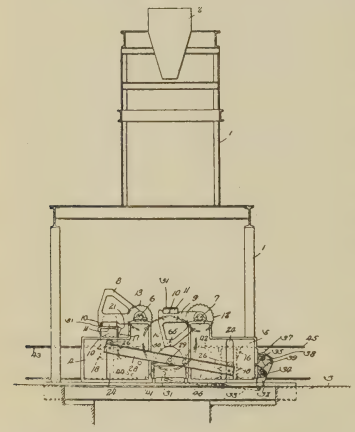
Heavy Clay Products

Report of Committee C-10 on hollow building tile. W. A. Hull. *Proc. A. S. T. M.*, **23** [1], 230(1923).—It is recommended that the present tentative specifs. for clay hollow bldg. tile continue as tentative and that certain revisions of the tentative definitions of terms relating to hollow tile be accepted. E. N. B.

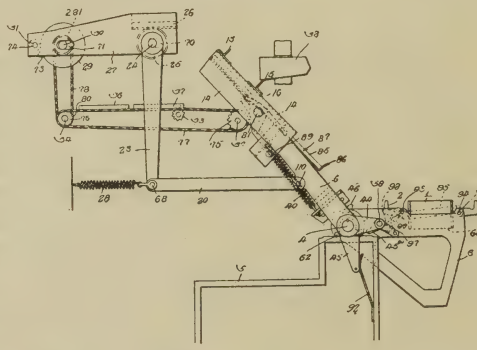
Tentative definitions of terms relating to hollow tile. Anon. *Proc. A. S. T. M.*, **23** [1], 640–3(1923). E. N. B.

Brickmaking at Quilon, India. Anon. *Brit. Clayworker*, **33**, 118(1924). H. G. S.

PATENTS

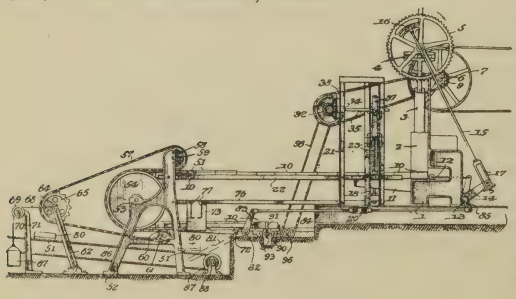


Brickmaking machine. Roy P. M. Davis. U. S. 1,506,221, Aug. 26,1924. In a brick making machine, a pair of pivoted mold supports and molds carried thereby, means for feeding a charge of mud alternately to the molds to form brick therein, means for simultaneously rocking said mold supports in opposite directions to filling and dumping positions respectively, a pair of vertically movable dumping tables one for each mold support, upon which the mold supports alternately deposit the brick carried thereby, means for simultaneously elevating one table and lowering the other, a brick conveyor, said tables when elevated receiving the brick from said mold support, and when lowered depositing the brick upon said conveyor, the movements of said mold supports and tables being in synchronism.



Pallet machine. Roy P. M. Davis and Irvin F. Hepler. U. S. 1,506,222, Aug. 26, 1924. In a brick making machine, a mold support and mold carried thereby, a pallet carrier, means for delivering a pallet to said carrier, said pallet carrier and said mold support being swingable about a common axis in opposing directions to bring said mold and the pallet on said pallet carrier into juxtaposition.

Brick machine. George C. Adams. U. S. 1,504,302, Aug. 12, 1924. In a brick machine, means for striking or rapping the molds comprising gravity-actuated pendant swinging hammers adapted to strike the sides of the mold, and means for raising and releasing said hammers to permit them to fall by gravity to deliver their blows on the mold. In a brick machine, means for unloading the molds containing the brick, comprising means for bringing the



molds and their pallets into inverted position, means for supporting the mold when in inverted position, shiftable means for engaging and supporting the pallet and the brick when the mold is in inverted position, and means for lowering away the pallet and brick from the mold, said means being adapted to disengage the pallet supporting means when operating to engage the pallet and permitting the pallet supporting means to return to supporting position to support the pallet on a succeeding mold when the pallet and brick of a preceding mold have been lowered.

Refractories

Silica brickworks and coke ovens. A. H. MIDDLETON. *Colliery Guar.*, **127,** 157(1924).—Silica brickworks and coke oven plant of the Consett Iron and Steel Co., Consett, England, were visited on July 10 by members of the North of England Inst. of Min. & Mech. Engrs. M. stated that these works have excited much interest with visitors from Holland, France, Germany, Austria, Australia, India and Czechoslovakia. Dr. Endell stated that he considered these the best equipped works in the world, and the mat. made there the best in the world, but he doubted whether it was commercially possible to put such mat. on the market. M. states they could put the mat. on the market as a commercial undertaking if people were willing to pay a little more for a good thing than a bad one. In bldg. their Fell ovens, of 3600 T. of silica brick made at their own works they had not cut one piece. The fire clay brick they bought had to be cut, costing in the latter case 3 times as much in bricklayers' wages for cutting brick as laying brick. A brick is never so strong after it is cut as a brick retaining the kiln skin upon it. It was no expt. in bldg. walls in coke ovens of silica. All coke oven walls found in America were built of silica. Other features were the high-speed machinery, the remote coke-quenching, and the iron and steel bindings. The big reduction in coking time accompanied by an increase in temp. and was one of the stumbling blocks in the way of coking engineers. Their old ovens were working at a max. efficiency as high as any in the country and these 21-in. ovens were pushed in 26 hrs. In the new ovens with a reduction of only 3 in. in the width they had reduced the coking time from 26 hrs. to 16 hrs. 20 min. without any increase in temp. The yields of by-products were the same as in the old plants. The coking time could be reduced further by raising the temps. and a reduction in coking time to $14^1/_2$ or 15 hrs. was possible. There was no reduction in size of coke except through the 3-in. reduction in the width of the oven. The largest size of coke was necessarily $1^1/_2$ in. smaller. The whole industry of silica brick-making has changed during the past 3 or 4 yrs. Research work of Dr. Mellor and the British Refractory Assoc. has helped. With regard to making of shapes by machinery, the number of shapes was so great in the Wilputte oven and other ovens (over 300 shapes being employed) the cost of the dies would be prohibitive. The plant has been in operation 14 wks. drawing 75 ovens per day. O. P. R. O.

Refractory facts. ANON. 158 pp.—A handbook of information about fire clay products, including a short outline of chemistry, issued by the Walsh Fire Clay Products Co. O. P. R. O.

Chromite (Transvaal). P. A. WAGNER. *S. Af. Jour. Sci.*, **20,** 223(1923).—The chromite of the Bushveld Igneous Complex: origin of chromite, its petrology, chem. compn. and anal. are discussed. Occurrence of chromite, its extent and economic conditions are dealt with; the article is illusd. with plates. O. P. R. O.

Graphite in Canada. H. P. H. BRUMMELL. *Jour. of Commerce*, **52,** 10(1924).—Canadian graphite material excels for crucible making. Canada promises to dominate the world's graphite industry. During the past few years the govts. of the U. S., Great Britain and Canada have been making exhaustive inquiries and investigations. It was not, however, until the advent of the oil frothing flotation method of concn.

had been perfected that it was possible to supply Canadian graphite at prices which allowed any profit to the producer. O. P. R. O.

What demands are made today upon the refractory materials in the cement industry? K. ENDELL. *Zement,* **13,** 230–3(1924).—Combining the usual testing of refractories with their life in practice. K. finds the kiln linings of clinker and cement to be the most economical. The app. used to det. the deformation of materials under load while heating is described. The action of the fusing clinker upon kiln linings is discussed. H. F. K. (*C. A.*)

Fuel and refractory lining material. HIRSCH. *Keram. Rundschau,* **31,** 14(1923); *J. Soc. Glass Tech.,* **7,** 194–5.—The necessity for the testing of refractory materials before use was emphasized. Particular reference was made to refractory materials for boiler-furnaces where the chem. action of slags was an important factor. The action of slag on refractory material was tested by placing pulverized slag in a cavity cut out of a block of the refractory material and burning the whole at Seger cone 14. The action of the slag was seen by cutting through the test piece. Eight slags of the following compn. were tested with blocks of the same shale: loss on ignition 0.5, 4.1, 2.6, 2.9, —, 0.1, —, 6.3; SiO_2 47.7, 52.3, 49.3, 45.6, 10.8, 46.3, 17.0, 5.8; Al_2O_3 42.9, 33.0, 31.9, 35.5, 9.6, 6.2, 17.2, 12.6; Fe_2O_3 3.8, 4.9, 6.3, 3.0, 25.5, 25.8, 15.5, 10.0; CaO 4.5, 3.5, 6.8, 6.7, 34.6, 19.8, 40.4, 50.6; MgO 0.1, 1.8, 1.5, 3.7, 1.6, 1.7, 4.6, 11.2; alkalis 0.6, —, —, 1.2, 1.6, 0.2, 0.2, 3.5; SO_3 —, 0.3, 0.1, 0.6, 16.4, —, 3.9, 0.1; S —, 0.1, 0.3, 0.9, —, —, 1.0, —; cone m. p. 27, 17, 14, 12, 10, 9, 12, 11. The first 4, which were coal slags, had only a slight corrosive effect. The lignite slags (numbers 5–8) produced corrosion in varying degree, the last showing complete soln. of the walls of the cavity. With powerful slags, the most suitable refractory material was chosen by comparison, by testing the same slag with blocks of different refractory materials. The densest material was the most resistant to attack. The action of a slag rich in Fe_2O_3 and CaO was tried on a shale, first, unprotected, secondly, with a facing of corundum, thirdly, with SiC, and fourthly, with a lining of "dynamidon," a product with more than 70% Al_2O_3. The last-named proved most efficient, the slag having no action. Low d., high Al_2O_3 content, and high degree of refractoriness (not less than Seger cone 28) were shown to be very necessary properties. It was also important that the bricks should be uniform and free from flaws. They should have sharp edges, ability to withstand changes of temp., a compression resistance of at least 80 kg. per sq. cm., and an after-shrinkage, when heated to Seger cone 14, of not more than 2%. The cement used should also be adapted to the slag and the joints should be made as thin as possible. The fire-box of the boiler furnace should be built as big as possible to prevent too strong local heating by the flames, and trouble by deposits of slag. H. G. (*C. A.*)

Pyrometric test of refractory clays. F. J. A. DEJARDIN. *Rev. universelle mines,* **2** [7], 49–55(1924).—A procedure is described for testing clays by the Seger-cone method, which is claimed to be particularly reliable. A furnace which is essentially a modification of that of Meurice (cf. *Cours d'Analyse Quantitative des Matières Minérales, Paris,* **1908,** 123) is recommended for carrying out the heating. The sample is ground to pass a 1-mm. sieve and kneaded to a firm paste with H_2O. On compressing in the proper mold, a thin paper core may be found convenient for easy removal. Drying should be done in the open at 16–18° and should be very slow (at least 3 days). Not over 55–60 min. are required for reaching 1690°. C. C. D. (*C. A.*)

Softening of refractory materials. H. HIRSCH AND M. PULFRICH. *Tonind. Ztg.,* **47,** 801–6(1923).—Ten silica bricks and one sample of quartzose shale were analyzed and the normal refractoriness, the refractoriness under a load of 1 kg. per sq. cm., porosity, crushing strength, expansion, and sp. gr. were detd. All but one of the silica bricks and the quartzose shale showed a slight expansion when heated, though this

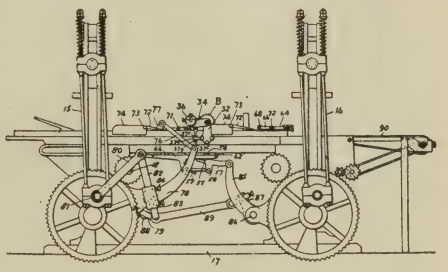
was very slight below 1300°. The failure occurred in each case very suddenly, the difference between the temp. at which softening was first observable and that at which collapse occurred being less than 100°, and often less than 30°. The silica brick which behaved differently from the others contained only 89% SiO_2 and as much as 5.8% Al_2O_3, and therefore contained clay. It behaved like a brick made of clay and quartz. Eighteen fire clay bricks when similarly heated under a load of 2 kg. per sq. cm. retained their vol. to about 1250°, and then began to contract. They did not collapse suddenly, like the silica bricks, but slowly lost their shape as the temp. rose, except those bricks which contained over 80% SiO_2; these bricks collapsed more suddenly, but not so rapidly as silica bricks. B. C. A. (*C. A.*)

Broken saggers as grog. Anon. *Brit. Clayworker*, **33**, 114(1924).—The use of broken saggers as grog for fire brick is recommended. This has the advantage over other grog in that it has been repeatedly fired. H. G. S.

The sortening temperature of fire brick. Hirsch and Pulfrich. *Brit. Clayworker*, **33**, 112(1924).—Silica brick do not deform out of shape under load until 1300°C is reached. Some of the purer brick do not deform until 1500–1700°C is reached. The first signs of softening of fire brick under load is evident between 1130° and 1390°C and the rapid collapse is between 1370° and 1700°C. Magnesite brick begin to soften under load at 1430°C and 1625°C. The difference in temp. between the commencement of softening and complete collapse is between 50° to 80°. H. G. S.

PATENT

Brick machine. James R. Tackett. U. S. 15,889 (reissue), Aug. 12, 1924. Original No. 1,460,455, dated July 3, 1923. In a brick-treating machine, a brick press, a brick re-press in spaced reln. to each other, a brick support interposed between the presses on which bricks are transferred from one press to the other, horizontally reciprocating brick pushing elements for engaging bricks and pushing them over the support, vertically and longitudinally reciprocating brick-carrying elements in operative relation to the support for lifting the bricks from the support and transferring them longitudinally thereof and re-depositing them thereon, and means for operating the brick-pushing elements and brick-carrying elements oppositely.



Whitewares

Contribution to the better knowledge of genuine hard porcelain. K. H. Reichau. *Trans. Ceram. Soc.* (Eng.), **23**, 145–53(1923–24).—Describes the application of the polarizing microscope to det. the structure of porcelains and glazes. H. F. S.

The effect of different grades of feldspar and iron oxide on stoneware clays and floor tile made therefrom. Kurt Samson. *Trans. Ger. Ceram. Soc.*, **5**, 1(1924).—Tests made in the research lab. of the state porcelain works in Charlottenburg with 3 characteristic floor tile clays, 2 German and 1 Norwegian feldspar and iron oxide. Test pieces burnt at Seger cones 010a, 05a, 1a, 3a, 6a, 10 and 12 were tested for (1) shrinkage and sp. gr. The clays showing the earliest vitrification were the first to reach their max. shrinkage. The mixts. with higher feldspar content vitrify later and shrink less. All showed a lowering of sp. gr. with advance in burning temp. Mixts. contg. feldspar burnt to vitrification showed the lowest sp. gr. (2) Toughness by the Singer impact bending test. The clays alone fired to vitrification showed the highest but most ir-

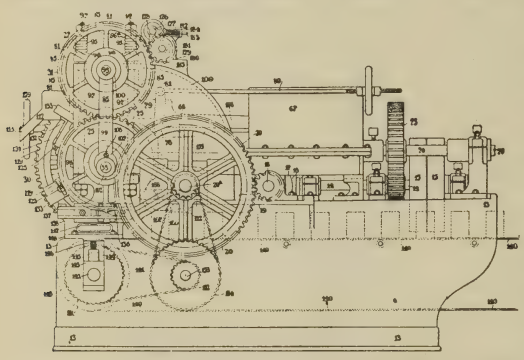
regular result. Addn. of feldspar lowers the resistance but stabilizes the values obtained. Addn. of iron oxide increases the resistance. (3) Compressive strength. Results similar to (2) but iron oxide reduces strength. (4) Resistance to wear by the Gary sand blast method. The clays alone fired to vitrification as in (2) stood up the best and additions of feldspar lowered and in some cases increased resistance. Iron oxide lowers resistance only very slightly. The outcome of these tests indicated that theoretically the clays alone fired to vitrification showed the highest average in the tests but would occasion mfg. difficulties if used alone. A mixt. contg. 20–30% feldspar and well vitrified is recommended as being the best compromise. F. A. W.

Porcelain clays of Ballarat, Victoria, Australia. R. C. Callister. *Chem. Eng. and Mining. Rev.*, **15**, 26(1922).—There seems little prospect of an extensive indus. in all grades of whiteware manuf. in Victoria, until a china clay indus. has been established. While large quantities of china clays are available, upwards of 8,000,000 T., they are not sufficiently pure to be available for use even after a treatment similar to that given in Cornwall (Eng.). However, ware, if not absolutely white, yet of pleasing tints and with decoration to match, might indicate a way to prepare ware capable of competing with good imported ware. O. P. R. O.

The German electrical porcelain industry. W. Huth. *Elektrotechn. Z.*, **45**, 688(1924).—Brief comment on the present status of the indus. C. G. F. (*C. A.*)

PATENT

Press for the manufacture of hollow earthenware articles. Edmund William Leigh. U. S. 1,505,042, Aug. 12, 1924. A rotary press for the simultaneous stage by stage manuf. of hollow earthenware articles, comprising a rotary carrier-head, a series of molding cylinders in said head, a hopper for successively filling each of said molding cylinders with plastic mat., means for subsequently compressing said plastic mat. within the molding cylinder to partly mold the article so as to form a base connected to a thick annular wall both of plastic mat., means whereby said thick annular wall of plastic mat. is after that subjected to extrusion to form the relatively thin annular wall of the hollow earthenware article, a cradle for supporting the article while it is being extruded and a traveling conveyor to successively receive and remove the completed articles.



Equipment and Apparatus

Apparatus for measuring humidity. Karl Holzhausen. *Feuerungstech.*, **12** [17], 141(1924).—Describes various types of instruments used for detg. humidity under the headings (1) app. depending on the phys. change of some mat. such as hair, and gut used as indicators only and not for exact measurements, (2) app. based on the wet and dry bulb principle, (3) thermoelec. app. for distant readings, (4) app. for detg. humidity in hot gases and such contg. impurities such as smoke, dust, etc., (5) continuous registering devices. F. A. W.

The Ruths steam accumulator. Anon. *J. Soc. Chem. Ind.*, **43**, 765–6(1924).—The principle of accumulating exhaust steam to a partial extent has been used for many years. Johannes Ruth of Stockholm (first pat. 1913) set out on new lines by stor-

ing the steam in heated water. Accumulators with a storage capacity of 25,000–70,000 lbs. of steam are in operation. The advantage from a factory point of view is that the boiler plant can be kept running at a steady steam output and press., while the steam is stored and delivered to the plant as required. The accumulator consists of a large cylindrical container, generally horizontal, with hemispherical ends, built of steel plates; it is almost full of water, to 90.95% capacity, and covered with insulating mat. The steam main, provided with non-return valves, passes under the surface of the water along the length of the accumulator, and has attached 16 branch pipes leading downwards into wide-mouth nozzles which go about to the bottom. The steam passes out through a delivery tube, and the whole is arranged to be automatic. A special form of accumulator is supplied to deliver superheated steam; it consists of 2 containers on the regenerative principle of 1 accumulator for superheated steam and the other for latent heat. The Ruths accumulator is said to foreshadow a radical alteration in the design of steam boilers. H. H. S.

The Lutelia mechanical excavator. ANON. *Brit. Clayworker*, **33**, 115–6(1924).—A French excavator which digs clay from the bank of clay and loads it into cars or carts is described. H. G. S.

Aerial ropeways. ANON. *Brit. Clayworker*, **33**, 106–9(1924). H. G. S.

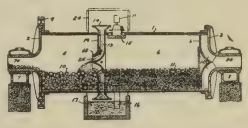
The determination of ash fusibility. E. MERTENS. *Bull. fed. ind. chim. Belg.*, **3**, 292–301(April, 1924).—A C resistance furnace is described, the heating element of which is a graphite tube 30 cm. long, 3 cm. outside diameter, walls 3 mm. thick, a current of 1 amp./sq. mm. cross-section giving a temp. of 1500° while 2 amp. gives 2000°. Oxidation of the tube is prevented by passing through it 8 l. of N per hr. Ash samples are ground to approx. 175 mesh and molded into tetrahedra with water and a little starch, temps. being measured with an optical pyrometer. The classification of coals by ash m. p. is very briefly mentioned. W. B. P. (*C. A.*)

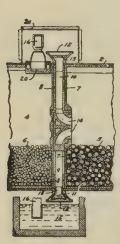
The technic of temperature measurements. KARL HENCKY. *Z. Ver. deut. Ing.*, **68**, 297–301(1924).—Thermometers which measure their own temps. correctly may fail to take up the temp. of the gas or fluid they are measuring. This error is due to heat flow along the thermometer or its inclosing tube, and is frequently, and needlessly, too large to be overlooked. Well-known formulas are applied to det. the amt. of this error in its dependence on dimensions and materials, and tables and curves are given to show the results. W. P. W. (*C. A.*)

The measurement of air temperatures in closed spaces by thermometers shielded from radiation. H. HAUSEN. *Z. tech. Physik*, **5**, 169–86(1924).—On the basis of a lengthy theoretical discussion, a complicated formula has been derived by means of which the error in temp. due to radiation may be calcd. Extensive exptl. data are given which agree with those obtained by means of the theoretical formula. J. H. P. (*C. A.*)

PATENTS

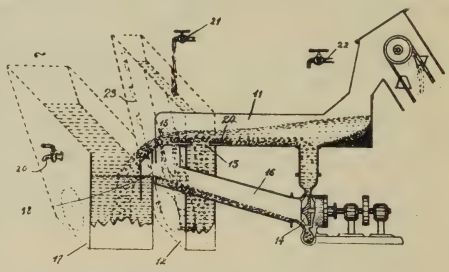
Comminuting mill. RAY C. NEWHOUSE. U. S. 1,504,777, Aug. 12, 1924. In a comminuting mill, a rotary drum, means for introducing mat. into an end of said drum, and an external scoop movable with said drum to introduce mat. from an outside source directly into said drum remote from said end, a portion of said scoop extending transversely of the drum axis and substantially parallel to the drum periphery. In combination, a rotary drum having uniform diam. throughout its length, a partition dividing said drum into a plurality of chambers, comminuting means in each of said chambers, means connected with said partition for delivering reduced mat. from one of said chambers, a stationary receptacle adapted to receive said reduced mat., and means connected with said drum for feeding mat. from said receptacle into another of said chambers.





Comminuting mill. RAY C. NEWHOUSE. U. S. 1,504,778, Aug. 12, 1924. In combination, a rotary drum, an annular screen rotatable with said drum and having side walls, and a spreader located within said screen and between said walls, said spreader being formed to direct mat. delivered from said drum over all portions of said screen.

Apparatus for washing minerals and other substances. RENÉ AUGUSTE HENRY. U. S. 1,505,024, Aug. 12, 1924. An improved app. for washing and sepg. minerals and other substances, comprising, a closed circuit structure, including a main trough, a return trough and connecting conduits for the troughs, a plurality of openings in the main trough, one of which openings leads out of the closed circuit structure, and is used for the heavier particles of mat., another of which openings leads to the return trough and is used for non-sepd. mat., and another of which openings leads to a settling tank, and is used for the lighter particles together with water, the settling tank having an opening connecting with the return trough for leading said water back to the closed circuit structure solely by gravity.



Kilns, Furnaces, Fuels and Combustion

A study of the physical properties of powdered coal of varying degrees of fineness. CHARLES ROSZAK. *Fuel in Science and Practice*, **3**, 161(1924).—In gen. it was found that the finer fractions contd. a slightly greater amt. of ash and of volatile constituents than the coarser fractions. Particles greater in size than 100-mesh usually show a somewhat quadrilateral shape. Finer than this they are more irregular. P. W. K.

New method of producing gas for industrial operations. R. MACLAURIN. *Trans. Ceram. Soc.* (Eng.), **23**, 121–44(1923–24).—Describes the Maclaurin gas producer which is a large producer 45 ft. high by 8 ft. square. It can be operated for the production of ordinary producer gas or as a gas retort producing coal gas, oil, ammonia, and a large residue of smokeless fuel (soft coke). M. claims it is more economical than other gas producing systems. H. F. S.

New methods in the design of high-duty furnaces for the combustion of lignite. PRADEL. *Feuerungstech.*, **12** [15], 123(1924).—Discusses recent developments leading to the use of lignite as a fuel to take the place of steam coal or anthracite. F. A. W.

Inspection and control of combustion in furnaces. A. DOSCH. *Feuerungstech.*, **12** [13], 107; [14], 116(1924).—Shows that with the customary method of only detg. the CO_2 in the flue gases, a high CO_2 content may not necessarily prove efficient combustion of the fuel but merely indicate a lack of air with the result that considerable quantities of unburned gases are generated. The author describes a practical app. which measures and indicates the draught in the fur. and stack and a certain established ratio between these gives the highest efficiency. F. A. W.

Tunnel kilns for brick. ANON. *Brit. Clayworker*, **33**, 122(1924).—A review of a discussion on this subject which was recently published in *Tonind. Ztg.* H. G. S.

Efficiency in kiln firing. ANON. *Brit. Clayworker*, **33**, 122(1924). H. G. S.

Burning brick with tar. ANON. *Brit. Clayworker*, **33**, 120–1(1924).—The use of tar to burn brick has been tried on the Continent. The tar was stored above the kilns where the heat kept it in a fluid condition and thus allowed it to flow into the kilns.

Any desired temp. can be reached with this fuel, cone 15 having been easily obtained at Eisleben. H. G. S.

Burning in clamps. ANON. *Brit. Clayworker*, **33**, 102–6(1924).—Different methods of burning in clamps are described. H. G. S.

Correcting a badly fired kiln. ANON. *Brit. Clayworker*, **33**, 101(1924).—The writer was troubled with overburned ware in top central portion of kiln and underburned ware in the bottom. A more uniform burn was obtained by firing with less coal each time and admitting a little more air over the fires. Firing slower also improved the uniformity of product. H. G. S.

Combustion of pulverized coal. E. AUDIBERT. *Fuel in Science and Pract.*, **3**, 56(1924).—The time required for complete combustion of various powd. coals under various conditions was studied. Increasing the air up to 40% excess, decreased the time of combustion. Particles between 220- and 240-mesh burned 2 or 3 times as rapidly as those between 120 and 140. The amt. of ash in the coal up to 50% had little effect. In gen. the higher carbonaceous coals burn more quickly than those high in volatile matter. Some coals would not burn except on addn. of some secondary air. Anthracite and coke were burned provided the grinding was sufficiently fine. 3 to 15 cu. m. per ton hr. should be sufficient combustion space. Commercial combustion chambers could be greatly reduced in size if the dust were injected slowly, the area of chamber wall contg. burners reduced in size, or air introduced as secondary air, and the chamber maintained at a higher temp. near the burner. P. W. K.

Thermal conductivity and specific heat of coal. F. S. SINNATT AND H. MACPHERSON. *Fuel in Science and Pract.*, **3**, 12(1924).—Sp. heat was found to be nearly 0.25 at atmospheric temp. for all coals tested. Of the banded ingredients of coal, clarain was found to have a lower heat condy. than durain which might explain the tendency of many coals to fracture readily on heating. P. W. K.

Furnace efficiency. ANON. *Queensland Govt. Min. Jour.*, **25**, 261(1924).—Because of lack of modern methods of scien. control the av. net working efficiency is only about 60%. In the working of fur. in the ceram. indus. the efficiency of combustion is very much lower because it is difficult to det. the exact performance of furs. of this character. Tests were undertaken by a firm of fire clay and refrac. mfgrs. with the object of detg. on practical lines the exact saving that could be obtained by the use of the "turbine" forced draught steam jet fur. in place of the ordinary bars and natural draught. The tests were carried out on a typical kiln with a content of 15 T. of fire clay products. Under the ordinary conditions of firing the fuel consumption was 2.46 (2500 kilos) of coal and 0.23 (240 kilos) coke, while the total duration of the htg. was 30–32 hrs. When the turbine fur. was installed, a similar series of tests showed that the fuel consumption was reduced to 1.99 T. (2030 kilos) of coal and no coke, while the duration of htg. was 20–25 hrs., *i. e.*, by adopting up-to-date methods in this respect, the saving was 0.69 T. (800 kilos) of fuel, or 25% of the total for every firing and the time of htg. was cut down by 10 hrs. in every 30. The coal used throughout was the same low-grade Belgian quality contg. 20–22% volatile matter, and for the lighting up of the kiln the same amt. of wood was weighed every time. The quality of the products obtained was distinctly superior. The color was more uniform, a fact to which great importance is attached in Belgium, while the total breakages were only 1% as compared with 7% for ordinary methods of firing. This is due to the fact that much less excess air is used with the turbine fur. so that the expansion and contraction of the charge is reduced to a min. O. P. R. O.

Classification of coal that will enable the buyer to know what kind of coal he is getting. G. H. ASHLEY. *Coal Age*, **25**, 167–71(1924).—This classification is based upon the percentage of fixed C detd. by a "standard analysis" whereby the values are re-

calcd. to a hypothetical 7% ash and the moisture is detd. by drying at 68°F and a pressure of 15 mm. Hg. The following table gives the designations of the various classes:

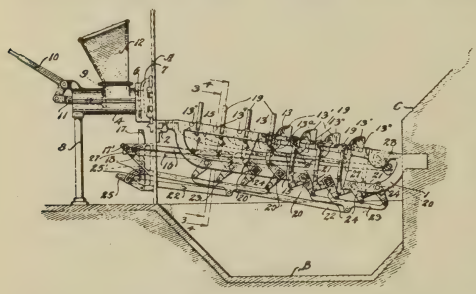
Descriptive names	Short name	Code name	Fixed-C range	Water	Volatile	Fixed C	Ash	Fuel ratio
Anthracite	Anthracite	Coal 88	83	3	2	88	7	12+
Semi-anthr.	Semi-anthracite,	Coal 82	80–82	3	7	77	7	12−8
Semi-bitum.	Loervol	Coal 77	74–79	3	13	70	7	8−5
Low-volatile	Lovol	Coal 70	65–73	3	20	70	7	5−3
Medium-volatile	Midvol	Coal 63	60–66	3	27	63	7	3−2
High-volatile gas coal	Hivol	Coal 56	53–59	3	34	56	7	2−
High-volatile	Hiervol	Coal 49	46–52	6	38	49	7	2−
High-volatile sub-bituminous	Moistvol	Coal 42	39–45	15	36	42	7	2−
Sub-bituminous	Himoist	Coal 35	32–38	25	33	35	7	2−
Lignite	Lignite	Coal 28	25–31	40	25	28	7	2−

H. L. O. (*C. A.*)

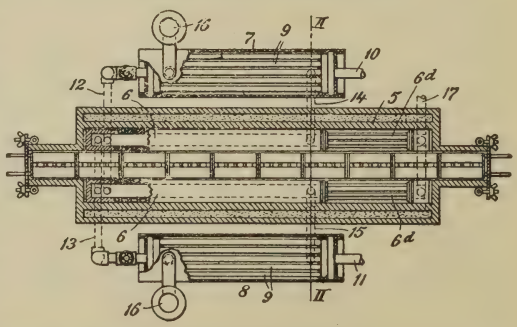
The application of the electric furnace to the porcelain industry. P. Blot. *J. four elec.*, **33**, 116–8(1924), 2 illus.—The advantages of elec. firing are discussed and a small elec. resistor furnace for 110–220 v. is described. It is similar to muffle furnaces used for rivet heating. C. G. F. (*C. A.*)

PATENTS

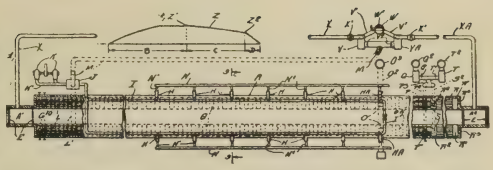
Hand-operated stoker mechanism for furnaces. John J. Bridgeford. U. S. 1,506,560, Aug. 26, 1924. In fur. stoker mechanism of the class described, an inclined grate comprising a plurality of rocking shaking bars arranged in series and projectable toward the lower end of the grate, means for operating the bars of said series at will, a plurality of plungers arranged at spaced intervals below the plane of the grate bars and mounted to penetrate vertically above said plane, and means for imparting substantially vertical movement to the plungers to cause the same to pass upwardly into the fuel bed.



Tunnel kiln. Philip Dressler. U. S. 1,506,573, Aug. 26, 1924. In a tunnel kiln the combination of a htg. means therefor comprising internal combustion chambers, means for supplying fluid mat. to said chambers to maintain combustion therein and means comprising a plurality of outlets from said combustion chambers for regularly preheating said mat. by products of combustion withdrawn from said chambers.

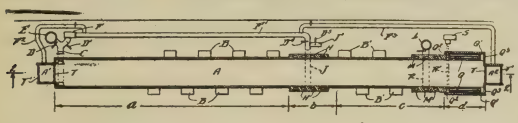


Tunnel kiln and method of operating same. Philip Dressler. U. S. 1,505,767, Aug. 19, 1924. In a continuous tunnel kiln, the combination with the kiln chamber,



of means for supplying heat to a htg. up and high temp. zone of the kiln chamber and means for regulating the temp. in another zone of the kiln chamber comprising conduits extending along said last mentioned zone, and means for passing either a htg. medium or a cooling medium through said conduits.

Tunnel kiln and method of operating same. PHILIP DRESSLER. U. S. 1,505,768, Aug. 19, 1924. The method of operating a tunnel kiln which consists in maintaining a high temp. zone, an initial cooling zone and a slow cooling or low temp. soaking zone in the order stated between the entrance and exit ends of the kiln by exerting a cooling effect on the rapid cooling zone portion of the kiln and supplying heat to the kiln chamber in each of the other of said zones.



Geology

Chemical exchange reactions of a zeolite. C. J. FRANKFORTER AND F. W. JENSEN. *Ind. Eng. Chem.*, **16**, 621–4(1924); *J. S. C. I.*, **43B**, 652(1924). H. H. S.

Kaolin (South Australia). ANON. *So. Aust. Dept. Mines, Min. Rev.*, [39], 54–8 (1924).—Rept. of the operations of a company (Kaolin, Ltd.) The raw mat. is a very soft argillaceous sandstone; anal. of several samples are given and the details of equipment and operation in the making of fire brick are described. The brick produced is burned at 1450°C, controlled by Seger cones and the product is a white siliceous brick, not very hard owing to absence of vitrification, but ringing well when struck. It is reptd. to be in favor among users. Some minor products from the plant are water-glass, ultramarine and kalsomine or cold water paint. O. P. R. O.

Asbestos industry (Russia). N. S. MIKHEIEFF. *Trans. Inst. Econ. Min. and Petrog., Moscow*, [7], 1924.—A treatise of 192 pp. in the Russian language of the development of the indus., the 1st of a series of publications under the heading "Russian Commercial Asbestos," issued by the Inst. O. P. R. O.

Kieselguhr (Transvaal). T. G. TREVOR. *So. African Jour. of Indus.*, **7**, 458 (1924).—Kieselguhr occurs in the Amsterdam Dist., E. Transvaal; in Griqualand West, and Gordonia, as a deposit in the beds of certain small fresh-water marshes. It has been worked only to a small extent, mainly for use in boiler-lining mat. O. P. R. O.

Steatite (So. Africa). T. G. TREVOR. *So. African Jour. of Indus.*, **7**, 461(1924).—Steatite of excellent quality occurs in the Barberton District, and has been noted in other areas. O. P. R. O.

The feldspars of Russia. A. E. FERSMAN. *Matter on the Natural Productive Forces of Russia, Acad. Sci. Petrograd*, **4**, 1–19(1919); *Rev. géol.*, **5**, 178.—A detailed list of occurrences, with mineralogical and technical descriptions. The most valuable deposits are on the west coast of the White Sea and in the Urals. E. F. H. (*C. A.*)

The state of the talc industry in Russia. A. E. FERSMAN. *Rept. Commiss. on Productive Forces of Russia*, **1916**, No. 4, 75–9; *Rev. géol.*, **5**, 178.—The most valuable talc deposits of Russia are in the Caucasus, in the region of Kars, and in the Urals. E. F. H. (*C. A.*)

Chemistry and Physics

Measuring plasticity of clay. K. Pfefferhorn. *Brit. Clayworker,* **33,** 120 (1924).—A new method for measg. the plasticity of clay has been devised by P., which consists in dropping a wt. on a clay cylinder $1^5/_{16}''$ x $1^9/_{15}''$. The deformation of the clay cylinder is noted and the plasticity number detd. The per cent H_2O in the clay cylinder which is compressed $^1/_3$ of its original length is called the plasticity no. The foll. table shows the plasticity nos. and mineral compn. of 5 clays:

	Clay A	Clay B	Clay C	Zettlitz kaolin	Earthenware
Clay substance	70.2	90.6	87.9	94.2	53
Feldspar	3.7	2.0	3.4	1.8	12
Quartz	26.1	6.4	8.7	4.0	33
Plasticity number	26.6	34.0	28.0	33.5	23.2

H. G. S.

The distribution of impurities in clays. Anon. *Brit. Clayworker,* **33,** 122(1924).

H. G. S.

New method of preparing thin sections from sand. A. Mamourovsky and I. Samsonoff. *Trans. Inst. Econ. Min. and Petrog.,* 5(1923).—The method here described solves the problem of molding sands into thin sections, thus enabling their investigation by means of the mineralogical microscope. The procedure, minutely described in the Russian text, enables to produce sand-sections possessing following qualities: 1. The Canada balsam used as cementing mass is an amorphous compd. with a constant refraction index. 2. The sections of mineral grains are shaped into parallel-faced plates with the usual thickness of about 0.03 mm. 3. The surface occupied by the balsam is reduced to 10–12% of the square of the section. These properties enable us to apply the highly elaborated and various methods of the mineralogic-petrog. research to the investigation of sands. O. P. R. O.

Chemical analysis of clays. Ian Marsden Porter. *Indus. Aust. and Min. Stand.,* **72,** 38(1924).—An outline of a method for "ultimate" chem. anal. of a clay, which can easily be followed by any one accustomed to chem. manipulation.

O. P. R. O.

The effect of a current of air on the rate of evaporation of water below the boiling point. J. W. Hinchley and G. W. Himus. *Chem. Trade Jour. and Chem. Eng.,* **75,** 94(1924).—It was found exptly. that the wt. of water evapd. in unit time in still air is given by the equation $W = 0.02\ (P_e - P_d)^{1.2}$, where P_e is the press. of satd. vapor at the given temp. and P_d is the press. of water vapor in the air used for drying. For drafts up to 0.9 m. per sec., and between 20° and 60°C, the rate of evapn. was found to be $W = a(P_e - P_d)$, where a varies from 0.031 to 0.013 according to the draft.

P. W. K.

Detection of tin and mercury by means of a spot-test. N. A. Tananaeff. *Z. anorg. Chem.,* **133,** 372–4(1924); *J. S. C. I.,* **43B,** 619(1924).—Filter paper is soaked in mercuric chloride soln. and dried. A drop of soln. contg. stannous tin is placed on the paper and followed by a drop of aniline. Stannous tin is the only metal which will reduce mercuric salts to mercury, giving a black stain, in the presence of such a weak base as aniline. H. H. S.

Pure alumina from clay.—According to a new process for this manuf. published by Pederson, Norwegian clay is taken and air-dried to 5% water; mixed with chamber acid (sulphuric acid) leaving an excess of clay over acid. After 12 hours the mass is htd. up to 200°C, and then leached at 80°C by a counter-current system. The strong liquor, on cooling, gives $^1/_3$ of the alumina in the form of alum crystals, and the remaining alumina is pptd. in the same form by adding potassium sulphate. A pure salt can be

prepd. by recrystallizing this alum. The alum is decomposed by ht. so as to give alumina, and sulphate of potash, and, by extracting this mass with water, the insol. alumina is obtained, also the sulphate of potash, which latter is no doubt recovered and used again. O. P. R. O.

Mullite—a silicate of Al_2O_3. BOWEN, GREIG AND ZIES. *J. Wash. Acad. Sci.*, **14**, 183(1924).—Mullite, often thought to be sillimanite, has very nearly same properties. Mullite synthesized by Deville using SiF_4 on Al_2O_3 and SiO_2 at red ht. Occurs in nature as inclusions of tertiary intrusives of W. Isles on Island of Mull of Scotland, and Nun's Pass. These have as impurities Fe_2O_3, TiO_2 and alkalis. There is a 3rd source of occurrence being in crowns of glass pots. The refractive index increases as TiO_2 and Fe_2O_3 content is raised approaching that of sillimanite. Analyses of rock and glass pot crystals are as follows

	Rock	Glass pot
SiO_2	29.04	29.36
Al_2O_3	69.62	69.05
Fe_2O_3	0.50	0.86
MgO	....	1.12
K_2O	0.18	0.10
Na_2O	0.06	....
	100.20	100.49

S. S. C.

Magnetic and electrical properties of the ternary alloys Fe-Si-C. T. D. YENSEN. *Jour. Am. Inst. Elec. Eng.*, **43**, 558–76(1924).—The variations in the magnetic properties of iron and iron alloys, even of supposedly constant composition, have been puzzling to the users and investigators of ferro-magnetic mat. ever since the introduction of such mat. for elec. app. Y. started to investigate this problem over 10 yrs. ago at the U. of Ill., and has continued it at the Westinghouse Research Lab. since 1916, concentrating on iron and iron-silicon alloys. While the results obtained do not eliminate 100% of the difficulties, they go a long way in that direction. It has been found that carbon is largely responsible for the variations, because of the fact that amts. so small as previously to be regarded as traces (less than 0.01%) remain dissolved in the iron in the solid state, even after slow cooling, and have a tremendous influence on the magnetic properties. Of much less effect is carbon pptd. as pearlite, free cementite and graphite, the effect being in the order named. If the effect of dissolved carbon be represented by 100, the effect of carbon as pearlite is 16.5, of carbon as Fe_3C 2.25, and of carbon as graphite nearly nil. The form assumed by carbon—aside from the carbon in soln.—depends largely on the silicon content, and can best be explained by referring to Fig. 9. Besides carbon, it has been found that the grain size has a large and definite influence on the magnetic properties, due to the accompanying intercrystalline amorphous cement that may be regarded as an impurity similar to other intercrystalline impurities. The detrimental effect of sulphur, phosphorus and manganese on pure iron is in the order named, while phosphorus has a beneficial effect on high silicon alloys. The evidence obtained is to the effect that the increased reluctivity, coercive force, or hysteresis loss, due to carbon and other impurities that are pptd. combined with iron—including in this class the intercrystalline cement—is caused by the inherent corresponding property of these pptd. impurities. Regarding the tremendous effect of carbon in soln., it is suggested that this is due to the entering of carbon into the more or less stable equilibrium arrangement of the ferro-magnetic structure, upsetting this equilibrium arrangement. A. F. G.

Range of the mixed-crystal phase rich in aluminium in the quaternary system aluminium–magnesium–silicon–zinc. W. SANDER AND K. L. MEISSNER. *Z. Metall-*

kunde, **16**, 12–7(1924); cf. *C. A.*, **18**, 1077.—The amts. of Zn, Mg, and Si which Al can hold in solid soln. increase from 8%, 2%, and 0.5%, resp., at 20° to 65%, 12%, and 0.8%, resp., at 450°; consequently all Al alloys contg. quantities of these elements between the above limits will deposit them partly on cooling slowly. If the cooling is rapid, this action is suppressed, but takes place slowly at the ordinary temp., and is accompanied by a gradual increase in vol., hardness, and tensile strength. The equil.-diagram of the quaternary system Al–Zn–Mg–Si is developed from a consideration of those of the 4 ternary systems involved. B. C. A. (*C. A.*)

Constitution of ternary aluminium alloys. V. Fuss. *Z. Metallkunde*, **16**, 24–5 (1924).—In the 15 possible ternary systems comprising Al and 2 of the elements, Fe, Cu, Ni, Zn, Mg, and Si, the Al corner of the ternary diagram is intersected by a quasi-binary line only in the cases in which the addn. of the 2 elements to Al has a specifically new influence on its properties, namely, in the systems Al–Mg–Si, Al–Mg–Zn, and Al–Mg–Cu. Al decomposes the silicides of Fe, Ni, and Cu, liberating free Si and forming intermetallic compds., and addn. of any of these elements or of Zn to Al results in the formation of these compds. B. C. A. (*C. A.*)

The determination of the coefficient of expansion of metals and other materials of construction by means of the Marten mirror apparatus. H. Sieglerschmidt. *Mitt. Materialprüfungsamt*, **40**, 215–33(1922); cf. *C. A.*, **16**, 4166.—The measurements were made in such a way that the errors reported in the previous article were avoided. The coeff. of expansion of hot-pressed, cold-drawn and cold-rolled specimens of brass contg. 58% Cu, 2.5% Pb and the remainder Zn was measd. at temp. from 20° to 450°. The values found at 250–300° were always smaller when measd. during the heating than during the cooling of the specimen. Over the range 300–50° the reverse was true. Measurements of the coeff. of expansion for cast Al rods and hard-drawn Cu and bronze wire are also given. F. P. F. (*C. A.*)

Researches at high temperatures. XVII. The vapor pressures of the alkaline earth metals. Otto Ruff and Hellmuth Hartmann. *Z. anorg. allgem. Chem.*, **133**, 29–45(1924).—The vapor pressures of Mg, Ca, Sr, and Ba were detd. in an atm. of A by an improvement of the method of Ruff and Bergdahl (*C. A.*, **13**, 3054). The b. p. at 760 mm. as detd. by extrapolation of the exptl. vapor-pressure curves are: Mg, 1086°; Ca, 1175°; Sr, 1151°; and Ba, 1146°. The mol. heats of vaporization λ_s as calcd. (I) by Liempt's formula, and (II) from the b. p. by de Forcrand's formula are: Mg, (I) 43,500, (II) 30,900 cal.; Ca, (I) 85,000, (II) 33,100 cal.; Sr, (I) 84,700, (II) 32,500 cal.; Ba, (I) 83,100, (II) 32,400 cal. The lower (II) values are considered to be more probable. The calcd. heats of vaporization at 0° abs. are: Mg, (I) 47,300, or (II) 34,600 cal.; Ca, (I) 90,500, or (II) 38,400 cal. In order that equil. in which these metals occur as a gaseous phase may be calcd. by the Nernst heat theorem, the chem. const., $C = 0.14\lambda_s/T_s$, was calcd.: Mg, (I) 5.61, or (II) 3.18; Ca, (I) 8.34, or (II) 3.20; Sr, (I) 8.34, or (II) 3.19; Ba, (I) 8.21, or (II) 3.19. From Guldberg and Guye's relation, $T_{crit.} = 1.55\ T_s$, the crit. temps. are: Mg, 2100°; Ca, 2200°; Sr, 2175°; and Ba, 2150°. These values are only approx. as this relation has not been confirmed for such high boiling substances. MgO volatilizes on amorphous C at about 1500°, and on graphite at about 1800°. Above 1800° the reaction is so active that with small pieces of MgO the Leidenfrost phenomenon occurs. Its volatility is therefor greater from the more reactive form of C. That this is due to the reduction of MgO to Mg by the C at a relatively low temp., and to the relatively high vapor pressure of Mg, is substantiated by calcn. from the above data. R. H. L. (*C. A.*)

The melting point of graphite. Anon. *Nature*, **114**, 173(1924).—Expts. to det. the m. p. of graphite have been made by Ryschkewitsch and consisted in passing a heavy current through a graphite rod with constriction. At a certain temp. this constricted

portion suddenly disappears, and kinematography shows that this is not due to a gradual evapn. The temp. was also practically independent of press. Calcn. shows that the m. p. of graphite is about 3800° abs. *Chem. Zeit.* (July 15) gives an abstract of this paper on the m. p. of graphite, which was read at the Bunsen Gesellschaft at Göttingen in May. O. P. R. O.

Alumina from clay. H. SPECKETER. *Zeits. für Phys. Chem.*, **110**, 637–55(1924).—Shows that Germany will be able to supply its own aluminum ore in the future, as a result of recent work. The HCl process is preferable to the H_2SO_4 process. H. H. S.

BOOK

Report on Radiation and the Quantum Theory. J. H. JEANS. 2d. Ed. Pp. 86. London: Fleetway Press, Ltd. Price 7 s. 6 d. H. H. S.

PATENTS

China clay for pottery manufacture. T. M. STOCKER. Brit. 214,062, March 17, 1923. A suspension is formed of china clay in H_2O contg. a small proportion of Na silicate. The suspension is allowed to stand until 50–80% of the clay has settled out and the fine clay remaining in suspension is collected by use of a filter-press and may be washed and dried. (*C. A.*)

Method of preparing siliceous material. FRANCIS X. GOVERS. U. S. 1,506,118, Aug. 26, 1924. The method of prepg. silicic acid which comprises preparing a colloidal soln. of silicic acid and removing water therefrom before a "gel" has formed, the removal of water being carried to the extent that the solid product will not form a solid "gel" in the presence of water.

Process for production of aluminum chloride and other products from carbonaceous shales and like material. EDSON R. WOLCOTT. U. S. 1,506,104, Aug. 26, 1924. The process of making aluminum chloride comprising reacting with chlorine upon a residue derived from heating a carbonaceous argillaceous mineral, said residue comprising aluminous material and carbon.

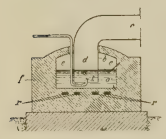
Titanium compound. JOSEPH BLUMENFELD. U. S. 1,504,669, Aug. 12, 1924. In the process of producing titanium oxide from mat. contg. titanium, the steps of mixing the said mat. with sulphuric acid, heating the mixt. initially to a temp. of at least 130°C and gradually increasing the temp. to a max. of 220°C, treating the resulting mat. with water in such propns. as to produce a soln. contg. about 15 to 25% of TiO_2, and subjecting that soln. to hydrolysis while avoiding the presence of any substantial amt. of ferric iron therein.

Titanium compound. JOSEPH BLUMENFELD. U. S. 1,504,670, Aug. 12, 1924. In the process of producing cryst. titanyl sulphate from mat. contg. titanium, the steps of mixing the said mat. with sulphuric acid, htg. the mixt. initially to a temp. of at least 130°C and gradually increasing the temp. to a max. of 220°C.

Titanium compound. JOSEPH BLUMENFELD. U. S. 1,504,671, Aug. 12, 1924. A process of producing titanium oxide from titaniferous mineral consisting in decomposing the mineral with not substantially more than 1 to 2 parts of sulphuric acid of about 80% strength, and treating the resulting mass with not substantially over 3 parts of water, while maintaining the mass at an approx. constant temp. near to the b. p. of the liquid until the titanium oxide is pptd., while any iron compound in the soln. is maintained in the ferrous state, and sepg. the oxide from the mother liquor and residue, substantially as described.

Preparation of titanium hydroxide. JOSEPH BLUMENFELD. U. S. 1,504,672, Aug. 12, 1924. The prepn. of titanium oxide or hydroxide by hydrolytic precipitation which comprises diffusing titanium from one soln. into another under the action of differential concn. and temp., and allowing the diffusion action to continue for several minutes before mixing the soln.

Method of preparing siliceous material. Francis X. Govers. U. S. 1,504,549, Aug. 12, 1924. The method of prepg. silicic acid, which comprises forming a jelly-like mass of colloidal silicic acid, drying the mass with the impurities therein until it will no longer revert to its prior gelatinous colloidal form in the presence of water, washing the dried material and again drying it.



Process for manufacturing oxide of white antimony. Antonin Germot. U. S. 1,504,685, Aug. 12, 1924. A process for making pure Sb_2O_3 suitable for the manuf. of paints and free from higher oxides, comprising blowing an oxygen contg. gas into a bath of molten antimony which is held in a closed chamber, and collecting the thus formed clouds of oxide of antimony in receiving chambers.

Purifying china clay. L. A. Holden. Brit. 214,699, Jan. 19, 1923. To remove brown coloration from china clay it is suspended in a soln. of Na sulfide or other alk. sulfide and dil. H_2SO_4 is then added until the mixt. is nearly neutral. After 5 or 6 hrs. more H_2SO_4 is added to dissolve out the FeS formed and ppt. the clay, which is then repeatedly washed with H_2O. The last washing may contain sufficient $Ca(OH)_2$ to neutralize acidity. (*C. A.*)

General

Physical properties of materials. I. Strengths and related properties of metals and wood. Bureau of Standards, *Circular* No. **101.**—The circ. represents a compilation of the most probable values, from a testing engineer's viewpoint, for the tensile, compressive, and shearing strength; ductility; modulus of elasticity; and other related properties of pure metals and their alloys, and of wood. In addn. to these, and whenever the existing data warranted, the circular gives the properties of metals at elevated temps. and their fatigue and impact properties. Values for other phys. props. include those for sp. gr., m. p., and the coeff. of expansion. Properties and uses of less commonly used metals are described briefly. Graphical representation is used in many cases to show the effect of ht. treatment, temp., and other conditions on the properties of a mat. References to the sources are given for all values in the circular. These include the exptl. results published in Amer. and European tech. periodicals, the specif. of tech. societies and of Govt. departments and unpublished results of the Bur. of Stand.
H. F. S.

Researches on the theory of fine grinding. Geoffrey Martin, Chas. E. Blyth and Harold Tongue. *Trans. Ceram. Soc.* (Eng.), **23,** 61–120(1923–4).—The research was carried out in the lab. of the Brit. Port. Cement Assn. with the financial assistance of the Privy Council for Financial and Indus. Research. The work was part of a program extending over $2^1/_2$ yrs. The raw mat. was crushed sand and the grinding machine was an 18″ x 18″ exptl. tube mill. The treatment of the data is highly mathematical. Briefly stated, it was found that the growth of the number of particles with decrease of diam. follows the law by which money grows at compd. interest. The law is probably the expression of the fact that crystals have a definite and fixed structure and consequently break up in the same regular and definite manner all down the scale of magnitude. Thus each set of particles breaks down in the same way so that the product (number of particles) produced by the breaking down of a small particle is, if sufficiently magnified, merely an image of the product produced by the breaking down of a large particle. Thus if sand of mean diam. d breaks down to give 2 particles of mean diam. d then each particle of d will break down to give 2 particles of an equidistant mean diam. d_2 and each particle of diam. d_2 will in turn break down to give 2 particles of an equidistant mean diam. d_3, etc. H. F. S.

Rotary steam boiler. Wintermeyer. *Feuerungstech.*, **12** [15], 127; [16], 137 (1924).—Describes the "atmos" superpress. boiler operg. under a press. of from 750–

900 lbs. per sq. in. which shows remarkable efficiency in opern. The shell is a seamless or welded tube rotating on its axis at about 300 r.p.m. which ensures absolutely uniform htg. throughout and obviates dangers arising from unequal expansion and contraction of the parts. The feed water is introduced in the center of one end and the steam taken off at the center of the opposite end. Another type has a stationary shell with internal horizontal paddles which in rotating carry the water around the circumference of the shell. Sketches show in detail methods used for automatically keeping the water level constant and an arrangement of safety check valves which instantly seal the in- and outlet in the event of the shell exploding. One of these boilers has been operating in a sugar refinery in Sweden for 2 yrs. with marked success. F. A. W.

Natural steam wells in Larderello. OKRASSA. *Feuerungstech.*, **12** [18], 149; [19], 157(1924).—Describes the harnessing of these natural steam wells in Italy for elec. power and light purposes. F. A. W.

Annual report of H. M., Chief Inspector of Factories and Workshops for the year 1923. *Jour. Soc. Chem. Ind.*, **43**, 771–3(1924).—*Lead poisoning.* In 1923 there were 11 deaths in potteries, and 5 not fatal cases in vitreous enameling shops. *Manganese poisoning.* The first definite cases of manganese poisoning in England are recorded this year. *Natural lighting of factories.* A new method of giving a good daylight illumination toward the center of wide buildings depends on refraction. The light is thrown horizontally across the room, no matter in what direction it falls on the outside of the windows, by means of "prismatic glass," the surface of which is ridged vertically at angles of 30° or 45° or 60°. H. H. S.

The making and burning of glazed ware. ANON. *Brit. Clayworker*, **33**, 98–9 (1924).—The prepn. of glazes for whiteware, hard glazes, soft glazes and colorless glazes on white bodies are described. H. G. S.

International conference, applied mechanics. *Jour. Soc. Chem. Ind.*—The first International Conference of Applied Mechanics was held at Delft, Holland, April 22. The sections were elasticity, mathematics, and hydro-dynamics. Among other papers Griffith illusd. his theory of rupture by expts. on vitreous silica fibres; Prandtl treated of problems arising from plastic deformation; Haigh studied rupture through fatigue from the standpoint of thermodynamics. The next conference will be at Zurich, Switzerland, in 1926. H. H. S.

Unfair competition. *Jour. Soc. Chem. Ind.*, **43**, 767(1924).—The federation of Brit. Indus. has set up a Comm. to consider the subject and to draw up recommendations to the Govt. with a view to consideration by Experts of the Economic Comm. of the League of Nations at Geneva in reference to the revised text of draft Articles of Convention on Unfair Competition. H. H. S.

Manufacture of ceramic wares (Union of So. Africa). JOHN ADAMS. *So. Af. Jour. Indus.*, **1**, 763–75(1918).—The subject ably discussed under the foll. headings: classification; principles of manuf.; historical sketch; present time, bricks, floor tiles and roofing tiles; fire clay, stoneware and silica goods; general earthenware and glazed tiling; future development. The article concludes with a bibliography. O. P. R. O.

Building materials (British Columbia). ANON. *Rept. of the Minister of Mines*, (1923).—Total output of structural mat. amtd. to $2,809,292—mostly from the Coast District. Excellent building-stone is found in abundance all over the Province and there are several well-equipped quarries along the coast; production of 1923. The sale of red brick in 1923 about 7800 M; the price varying from $12 to $16 a thousand. There is but one company producing fire brick at Clayburn. The manuf. of lime is small, but an increased demand for crushed rock and gravel. O. P. R. O.

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CERAMIC ABSTRACTS

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Abrasives

Manufacturing an artificial abrasive. Anon. *Chem. Met. Eng.*, **31**, 501–3(1924).—The manuf. of carborundum is described. Coke, sand, salt and sawdust are charged into a U-shaped elec. fur. A core of graphite through the center of the charge carries the current. After 36 hrs. the charge is cooled and sorted. There is a top crust of unconverted charge, an intermediate layer of partly converted mix. known as firesand,

[1] The abbreviation (*C. A.*) at the end of an abstract indicates that the abstract was secured from the Editor of *Chemical Abstracts* by coöperative agreement.

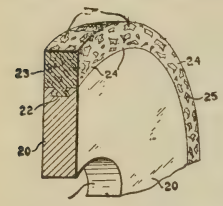
and inside, the pure carborundum. The large chunks of carborundum are crushed in pan crushers, digested with acid to remove harmful ingredients, washed, dried, and sized into 21 grades. M. E. M.

Making vitrified abrasive wheels. ANON. *Chem. Met. Eng.*, **31**, 531–3(1924).—Describes the manuf. of carborundum grinding wheels. Two methods are used: wet process and dry press. In the latter, the carborundum particles are tumbled in barrels with the bonding mat. for several hours. Water is then added till the mix has the consistency of molding sand. The wheels are pressed in steel molds by hydraulic presses and dried for several days before firing. In the wet process, the mats. are mixed with water to a thin paste, stirring for many hours. The stirrer is designed to eliminate admixture of air bubbles. The mix is transferred to metal molds lined with heavy paper, and worked by hand to eliminate air bubbles, then dried. The wheels are fired in down-draft, coal fired kilns in fire clay saggers. The firing cycle is 2 weeks. The fired wheels must next be dressed to size, and balanced before their final inspection.

M. E. M.

Manufacture of artificial abrasives in the electric furnace. C. J. BROCKBANK. *Birmingham Metallurgical Soc. Jour.*, **7**, 551–9(1924).—This article discusses the early history, manuf. and finishing of silicon carbide; aluminous abrasives or artificial corundum and manufacturing costs. It is illustrated and contains tables of analyses. O. P. R. O.

PATENT



Polishing wheel. CLARENCE R. KING. U. S. 1,507,836, Sept. 9, 1924. An abrasive article comprising a resilient cushioning body and spaced teeth of bonded abrasive grains united therewith.

Art

Color measurement with Lambert's mirror. HEINRICH TRILLICH. *Farben-Ztg.*, **28**, 1601–2(1923).—A very brief biography of Johann Heinrich Lambert (1728–1777), with a description of his mirror, which consists of a plane parallel glass plate set vertically across the center of a horizontal plate equally illuminated on all parts. Colored cards placed on the horizontal plate on opposite sides of the plane parallel glass will show varying degrees of transmission and reflection depending on the angle of observation of the glass. Expts. with this mirror on some of the colors making up Ostwald's color circles, show that it can be used for demonstrating color mixing, complementary colors, etc., and for the measurement of colors.

F. A. W. (*C. A.*)

PATENT

Manufacture of cement, burned lime, etc., in electric furnace. T. A. F. HOLMGREN. Swed. 50,536, Jan. 4, 1922. The raw materials are crushed into suitable grain sizes, mixed and fed into an elec. furnace. The heat is produced in one or more zones by a. c. which is applied through one or more circuits with phase-differences like 360° divided by the no. of circuits. Gas is drawn or forced through the furnace in opposite direction of the materials. (*C. A.*)

Cement, Lime and Plaster

How silica cement is made. P. H. JUNG. *Chem. Met. Eng.*, **31**, 465–7(1924).—Silica cement is used for laying silica brick. It is made from crushed silica bats and a high quality plastic clay in the ratio of about three to one. Crushed ganister is sometimes added, but is unnecessary. The clay used must be low in iron and alkalis. A typical anal. is given. The raw mat. may be crushed sep., then mixed and ground, or mixed, then crushed and ground. The 1st method is preferable. The mixt. is generally ground in ring roll pulverizers, and screened on inclined screens. If too fine a screen

is used, there is a tendency for the silica and clay to sep. The 3 most important tests for the finished product are fineness, fusion point and plasticity. M. E. M.

Concrete factory chimneys. *S. African Jour. of Indus.*, **7,** 503(1924).—A new method of constructing factory chimneys in concrete depends on the use of hard burnt tile and steel reinforcement in the shape of vertical bars and horizontal rings. The tile form the inner and outer walls and serve as permanent molds for the concrete. Being of comparatively small size, the tile also ensure that the concrete is placed carefully in small quantities, while the steel reinforcement gives resist. to wind-pressure and to cracking through temp. changes. In bldg. a chimney in accordance with this method, the foundation is put in with requisite reinforcement of vertical bars extending upwards, and an inner and outer ring of tile are set in mortar. The annular space is then partly filled with concrete, the circular reinforcement rings placed in position, and the filling continued level with the tile. Another row of tile is then laid as before, and the process continued, each course breaking joint with the next, and the joints being afterwards pointed in the same way as brickwork. It is claimed that with careful workmanship this method will produce a sound structure which is safe and durable, calling for the minimum of repairs and giving the max. of economy and permanence. (*London, Times Eng. Supp.*) O. P. R. O.

Sand-lime brick process. ANON. *Indus. Australian and Min. Stand.*, **72,** 296 (1924).—The value of sand-lime brick is equally proved by means of chem., mech. and phys. tests. Thus they have greater resist. to crushing strain than ordinary brick, and are less absorbent to water, while possessing equal porosity to the air. All are perfectly straight and of equal size, there being no twisting, bulging, or distortion, so that less mortar is required to lay them, and it is easier to obtain efficient results with plaster because of the smooth surface given. The process of manuf. is simple and can be carried out with unskilled labor. Mix sand intimately with 5 to 10% of thoroughly slaked lime, forming this into a semi-dry mass with water, passing it through a brick molding mach. operg. at 2 T. per sq. in. press., and then ht. for 10 hrs. in closed cylinders at a temp. of approx. 350°F under a steam press. of about 120 lbs. per sq. in. Under these circumstances a chem. reaction takes place between part of the silica and the lime, resulting in the formation of hydrated calcium silicates, which bind the whole mass together, forming an intensely hard, close-grained and homogeneous brick which somewhat resembles stone. The entire process can be completed, from raw mat. to finished brick in 24 to 36 hrs. in striking contrast to the many months of aging necessary in case of ordinary fired clay brick; the sand-lime method is in general cheaper, and has the advantage that sand occurs almost everywhere, while suitable clay does not. The lime should not contain the slightest trace of unslaked lime lest the brick expand, become distorted, weak and friable. If the lime is properly slaked, sand-lime brick is unquestionably superior to ordinary brick. O. P. R. O.

Cement manufacture possibilities in crown colonies. ANON. *Bull. of Imp. Inst.*, **22,** 173–93(1924).—The possibilities for cement manuf. in many Brit. possessions and the importance of utilizing local supplies has been investigated. For this purpose a lab. has been established with plant necessary for (1) the mech. prepn. of large samples of raw cement mat., (2) the carrying out of exptl. firing trials, and (3) the testing of the finished cement in order to ascertain whether it conforms to the standard specif. The article gives an outline of the manuf. and properties of different kinds of cement, special attention being devoted to the charac. required in raw mat. for the several classes of cement used in building. This is followed by particulars relating to the possibilities of cement manuf. in the various Colonies and Protectorates and an acct. is given of the deposits so far known and the results of tests conducted at the Imp. Inst. lab.

O P. R. O.

Contribution to the knowledge of the hydration process in the setting of Portland cement and of clinker. HANS PULFRICH AND G. LINCK. *Kolloid-Z.*, **34,** 117–9(1924).—Previous observers working with a large excess of H_2O have noticed during the setting of cement the formation of needles of a Ca silicate, then hexagonal plates of Ca aluminate, and finally the disappearance of the crystals with formation of a gel. In the hydration of clinker the hexagonal plates appear first, then the gel and crystals of $Ca(OH)_2$. The hexagonal plates were made synthetically by melting together 3CaO and Al_2O_3 and treating with H_2O. The crystals proved to be $3CaO.Al_2O_3.7H_2O$. The needles were also synthesized by making the tricalcium silicate by melting together $CaCO_3$ and SiO_2 and treating with H_2O. They can also be prepd. by treating a 5% SiO_2 soln. with $Ca(OH)_2$ soln., warming on the water bath and letting stand for a week. On prolonged standing both types of crystals decompose again to form a gel. When the amt. of H_2O added to the cement is cut down more nearly to the proportion used in practice by employing mixts. of glycerol and H_2O in place of H_2O alone for making the microscope slides it is found that the setting of the cement takes place without the formation of the needles, the reaction proceeding at once to the gel stage. It is, therefore, concluded that the hardening of cement is due to the formation of the gel rather than to the interlocking of the needle-like crystals. F. L. B. (*C. A.*)

The Segni (Rome) cement plant. F. FERRARI. *Cemento* **20,** 101–5(1923); *Chimie et industrie,* **11,** 1140(1924).—A description of the plant. A. P.-C. (*C. A.*)

Enamel

Principles of enameling. I. H. F. STALEY. *The Ceramist,* **4,** 6(1924).—The 1st of a series of articles for the special benefit of the man who has not had tech. training. The methods of calcg. melted wt. and percentage loss on melting, and coeff. of expansion without the use of chem. symbols are shown. C. W. P.

PATENTS

Production of a non-chipping enamel. R. MADES. Ger. Pat. 396,752, Dec. 29, 1922. (*Jour. Soc. Chem. Ind.*, **43B,** 788(1924).) The ground coat is applied in so dilute a condition that after firing it is invisible to the naked eye. Thus the finished ware can be subjected to very considerable shocks and blows. H. H. S.

Enamel paint. F. SCHAMBERGER. Ger. 376,569, *Oil & Color Trade Jour.*, **66,** 1052(1924). The sap of the shells of the oil-fruit seeds of Anacardium occidentale or A. orientale, or a mixt. of both, is used, with or without addn. of drying, binding, and hardening agents. O. P. R. O.

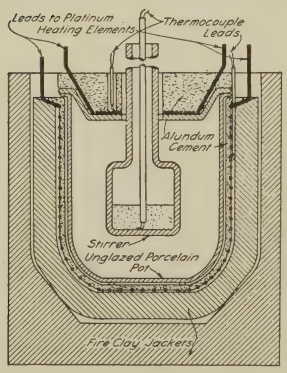


FIG. 1.—Diagram showing arrangement of parts of viscosimeter, heating circuits, and thermocouples.

Glass

The viscosities and surface tensions of the soda-lime-silica glasses at high temperatures. Part I. Viscosities of glasses at high temperatures. EDWARD W. WASHBURN AND GEORGE REED SHELTON. Univ. Ill. Eng. Expt. Station, *Bull.* **140,** April 14, p. 8–50 (1924).—*Method.* The method adopted was that of rotating cylinders, the glass being contained in an approx. cylindrical porcelain pot into which was dipped a hollow porcelain stirring cylinder. The latter was rotated at a measured speed by means of a system of falling wts. For a given apparatus employing a const. height of liquid, the simplified equation (2) holds

$\eta = k\frac{W}{S}$, where η is viscosity of the liquid, W the mass of the falling wt. which rotates the inner cylinder in the glass at S r.p.m., and k a const. of the apparatus which is detd. by calibration with liquids of known viscosity. *Standardizing liquids.* A series of glasses were prepared by mixing in proper proportions: water, dextrose and confectioner's glucose. A wide range of viscosities were thus obtained. The viscosities of these liquids were detd. by (1) the capillary-flow method, using viscosimeters of the Ostwald type, (2) the falling sphere method, using nickel-chromium steel balls and small drops of mercury, and (3) Washburn's capillary-penetration method. The compns. and viscosities of the standardizing liquids are given in Table 10.

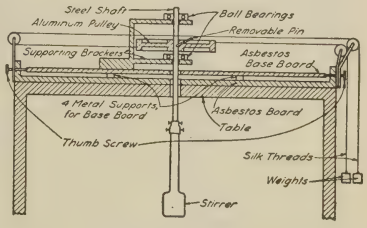


FIG. 2.—The driving mechanism.

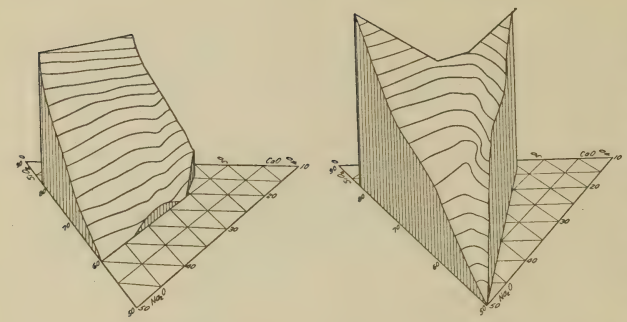
TABLE 10

SUMMARY OF VISCOSITIES OF VISCOUS LIQUIDS

Values in parentheses are taken from the literature

No.	Description of solution	Temp., deg. C	Capillary methods η	Capillary methods log η	Falling-sphere method η	Falling-sphere method log η	Value from curve of Fig. 7 η	Value from curve of Fig. 7 log η
1	60% Sucrose	24	(0.4638)	(−0.6663)	...	...	...	...
2	60% Sucrose	0.3	(2.330)	(0.3674)	...	...	...	...
3	80% Glucose				3.442	0.5369		
	$d^{25°}/^{25°} = 1.331$	25	3.696	0.5677	3.388	0.5299	3.43	0.535
					3.531	0.5479		
					4.186	0.6218		
4	Castor oil	24.8	(6.62)	(0.821)	...	...	...	...
5	Castor oil	21.75	(8.50)	(0.930)	...	...	...	...
6	90% Glucose				35.99	1.5562		
	$d^{25°}/^{25°} = 1.379$	25	36.62	1.5637	35.29	1.5477	36.6	1.562
					35.50	1.5502		
7	98% Glucose				749.3	2.8747		
	$d^{25°}/^{25°} = 1.420$	25	...	...	743.5	2.8713	764	2.883
					772.0	2.8876		
8	100% Glucose				5 699	3.7558		
	$d^{25°}/^{25°} = 1.436$	25	...	...	5 314	3.7254	3 000	3.475
					5 287	3.7232		
9	Glucose and				13 460	4.1291		
	Dextrose	19	13 620	4.1342	13 440	4.1284	16 600	4.220
	$d^{25°}/^{25°} = 1.447$				13 870	4.1418		
10	Glucose and				163 300	5.2130		
	Dextrose				163 300	5.2130		
	$d^{25°}/^{25°} = 1.470$	18.9	165 900	5.2199	165 000	5.2175	163 000	5.212
					167 600	5.2243		

The viscosities are given in *poises*, the poise being the tangential force per sq. cm. of area of either of two horizontal planes one cm. apart, one of which is fixed, while the other moves with unit velocity, the space being filled with the viscous liquid of unit viscosity. *Variation of the constant k in equation* (2) *with the viscosity of the liquid.* A brass app. was used consisting of two concentric hollow brass cylinders, the inner cylinder rotating within the outer one on bearings. The space between was filled with



(1500°C.) (1000°C.)

FIG. 10.—Models of the log η surface.

the liquid, and the const. k of the apparatus was detd. from the velocity attained by the inner cylinder, actuated by falling wts. From the results it is concluded that regardless of the viscosity of the liquid employed, the rate of shearing is directly proportional to the torque, but that the stirring friction viscosity as measured by the rotating-cylinder method is identical with the viscosity as measured by capillary or by falling-sphere methods, only as long as the viscosity does not exceed a certain value, possibly depending upon the dimensions of the rotating-cylinder apparatus. The value of k varied from 70 to 353, depending on the viscosity of the liquid. The caution is added that in measuring the viscosities of very viscous liquids by the rotating-cylinder method it is advisable to standardize the apparatus with a series of liquids of known viscosities, covering the range desired.

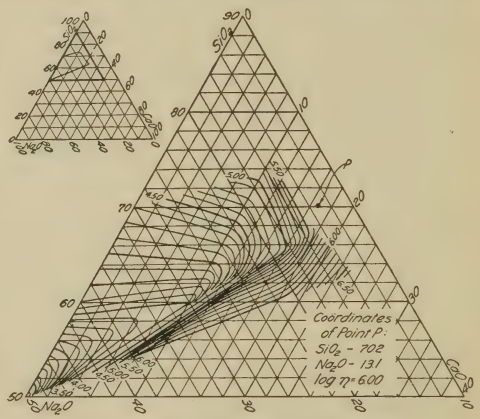


FIG. 12.—Log isokoms at 900°C.

Calibration of porcelain pots and stirrers. For each standardizing liquid, placed in a porcelain pot with stirrer in position, the straight line relationship between different falling wts. and the corresponding r.p.m. values were determined. The logarithms of the values of the slopes W/r.p.m. were plotted against the logarithms of the corresponding viscosities of the standardizing liquids. By detg. the values of W/r.p.m. for any unknown liquid, the viscosities can then be obtained from the curve.

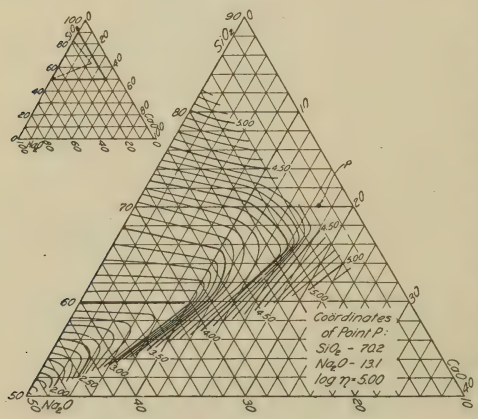


FIG. 13.—Log isokoms at 1000°C.

Viscosities of the soda-lime-silica glasses. By mixing three stock glasses of known compn. the following glasses were obtained, and investigated (Table 15). Chem. analyses of the stock glasses and of two mixtures indicated the slight variations in compn. due to melting. All the glasses contained small quantities of alumina, less than 1% in most cases.

TABLE 15

COMPOSITIONS OF GLASSES INVESTIGATED

Glass no.	Per cent of weight SiO_2	Na_2O	CaO
1	49.7	50.3	...
2	82.6	17.4	...
3	70.0	30.0	...
4	60.0	40.0	...
5	63.0	13.6	23.4
6	60.5	20.0	19.5
7	68.1	21.9	10.0
8	70.0	20.0	10.0
9	54.25	38.0	7.75
10	70.0	10.0	20.0
12	72.25	15.1	12.1
13	73.5	16.5	10.0
14	73.0	12.0	15.0
15	67.5	15.5	17.0
16	64.95	19.3	15.75
17	60.0	30.0	10.0

Results. From the values of log η obtained at definite temps. between 750° and 1500° C, curves were drawn from which the viscosities at round temp. intervals were interpolated.

TABLE 17

VISCOSITIES OF GLASSES INVESTIGATED

Values at round temperature intervals. Interpolated from the log η curves (Fig. 8)

Temp., deg. C	Glass number 1		2		3		4		5	
	log η	$\eta \times 10^{-3}$	log η	$\eta \times 10^{-3}$	log η	$\eta \times 10^{-3}$	log η	$\eta \times 10^{-3}$	log η	$\eta \times 10^{-3}$
1500			2.330	0.21_4	1.580	0.038	0.91	0.0081	1.19	0.015_5
1475			2.404	0.25_4	1.660	0.046	1.000	0.010	1.27	0.018_6
1450			2.478	0.30	1.735	0.054_4	1.085	0.012	1.35	0.022_4
1425			2.560	0.36	1.810	0.064_5	1.170	0.015	1.43	0.027
1400			2.638	0.43_4	1.887	0.077	1.257	0.018	1.510	0.032_4
1375			2.730	0.54	1.960	0.091	1.348	0.022	1.600	0.040
1350			2.835	0.68_4	2.037	0.11	1.440	0.027_5	1.690	0.049
1325			2.945	0.88	2.117	0.13	1.535	0.034	1.795	0.062_4
1300			3.070	1.2	2.205	0.16	1.630	0.043	1.913	0.082
1275			3.209	1.6	2.300	0.20	1.735	0.054	2.055	0.11_4
1250			3.355	2.2_6	2.403	0.25	1.840	0.069	2.223	0.17
1225			3.515	3.3	2.507	0.32	1.945	0.088	2.415	0.26
1200	0.93	0.0085	3.690	4.9	2.620	0.42	2.050	0.11	2.630	0.43
1175	0.985	0.0097	3.880	7.6	2.735	0.54	2.160	0.14_5	2.880	0.76
1150	1.040	0.011	4.085	12	2.860	0.72_5	2.270	0.18_6	3.150	1.4
1125	1.100	0.012_6	4.290	19.5	2.980	0.95_5	2.385	0.24	3.450	2.8
1100	1.167	0.015	4.500	31.5	3.104	1.3	2.500	0.31_6	3.770	5.9
1075	1.250	0.018			3.235	1.7	2.627	0.42_4	4.115	13
1050	1.350	0.022_4			3.367	2.3	2.758	0.57	4.450	28
1025	1.477	0.030			3.500	3.1_6	2.895	0.78_5	4.800	63
1000	1.620	0.042	5.4	250	3.640	4.3_6	3.040	1.1	5.165	14_6
975	1.780	0.060			3.795	6.2_4	3.196	1.6	5.55	
950	1.950	0.089			3.950	8.9	3.350	2.2		
925	2.130	0.13_5			4.120	13	3.515	3.3		
900	2.320	0.21			4.300	20	3.683	4.8		
875					4.500	$31._6$	3.865	7.3		
850					4.700	50	4.055	11		

TABLE No. 17 (*Continued*)

Temp., deg. C	Glass number 3 log η	3 η × 10⁻³	4 log η	4 η × 10⁻³
825	4.910	81	4.275	19
800	5.140	140	4.515	33
775	5.380	240		
750	5.630	430		

Temp., deg. C	Glass number 6 log η	6 η × 10⁻³	7 log η	7 η × 10⁻³	8 log η	8 η × 10⁻³	9 log η	9 η × 10⁻³	10 log η	10 η × 10⁻³
1500	0.93	0.0085	1.441	0.027_6	1.580	0.038			1.770	0.059
1475	1.030	0.011	1.527	0.034	1.660	0.046			1.865	0.073
1450	1.126	0.013	1.620	0.042	1.753	0.056_6			1.960	0.091
1425	1.224	0.017	1.710	0.051	1.847	0.070			2.007	0.100
1400	1.323	0.021	1.800	0.063	1.940	0.087	0.88	0.0076	2.160	0.14_5
1375	1.427	0.027	1.890	0.077_6	2.035	0.11	0.965	0.0092	2.220	0.16_6
1350	1.515	0.033	1.978	0.095	2.130	0.13_5	1.050	0.011	2.380	0.24
1325	1.612	0.041	2.065	0.11_6	2.230	0.17	1.140	0.014	2.502	0.32
1300	1.708	0.051	2.160	0.14_5	2.330	0.21_4	1.230	0.017	2.640	0.43_6
1275	1.814	0.065	2.258	0.18	2.437	0.27	1.330	0.021_4	2.810	0.64_6
1250	1.905	0.080	2.360	0.23	2.545	0.35	1.430	0.027	3.040	1.1
1225	2.015	0.10	2.470	0.29_5	2.660	0.46	1.540	0.034_6	3.375	2.4
1200	2.143	0.14	2.587	0.38_6	2.777	0.60	1.645	0.044	3.840	6.9
1175	2.315	0.21	2.715	0.52	2.900	0.79_4	1.757	0.057	4.315	21
1150	2.560	0.36	2.860	0.72_5	3.030	1.1	1.870	0.074	4.760	$57._5$
1125	3.000	1.0	3.000	1.0	3.165	1.4_6	1.995	0.099	5.240	174
1100	3.53	3.4	3.140	1.4	3.306	2.0	2.130	0.13_5	5.79	620
1075	3.98	9.5_5	3.290	1.9_5	3.455	2.8_6	2.395	0.25		
1050	4.34	22	3.450	2.8	3.603	4.0	2.700	0.50		
1025	4.65	45	3.603	4.0	3.765	5.8	3.050	1.1		
1000	4.95	89	3.765	5.8	3.930	8.5	3.415	2.6		
975	5.23	170	3.935	8.6	4.103	$12._6$	3.795	6.2_4		
950	5.51	$32_4.$	4.100	$12._6$	4.284	19	4.200	16		
925			4.270	$18._6$	4.477	30	4.835	$68._4$		
900			4.445	28	4.685	$48._4$	(6.05)	$1100._0$		
875			4.622	42	4.910	81				
850			4.800	63	5.132	$13_6.$				
825			5.000	100	5.370	$23_4.$				
800			5.185	150	5.630	430				
775			5.390	$24_5.$						

Temp., deg. C	Glass number 12 log η	12 η × 10⁻³	13 log η	13 η × 10⁻³	14 log η	14 η × 10⁻³	15 log η	15 η × 10⁻³	16 log η	16 η × 10⁻³	17 log η	17 η × 10⁻³
1500	1.627	0.042_4	1.680	0.048	2.43	0.27	1.57	0.037	1.41	0.026	1.08	0.012
1475	1.742	0.055	1.805	0.064	2.52	0.33	1.650	0.044_6	1.49	0.031	1.17	0.015
1450	1.856	0.072	1.930	0.085	2.62	0.42	1.735	0.054	1.57	0.037	1.26	0.018
1425	1.970	0.093	2.060	0.11_5	2.71	0.51	1.823	0.066_5	1.66	0.046	1.35	0.022_4
1400	2.090	0.12	2.180	0.15	2.805	0.64	1.910	0.081	1.750	0.056	1.445	0.028
1375	2.210	0.16	2.310	0.20_4	2.900	0.79_4	2.000	0.10	1.840	0.069	1.535	0.034
1350	2.330	0.21_4	2.440	0.27_5	3.000	1.0	2.098	0.12_6	1.930	0.085	1.625	0.042
1325	2.445	0.28	2.570	0.37	3.09	1.2	2.200	0.16	2.020	0.10_5	1.715	0.052
1300	2.560	0.36	2.700	0.50	3.190	1.5_5	2.320	0.21	2.120	0.13	1.805	0.064
1275	2.680	0.48	2.840	0.69	3.300	2.0	2.450	0.28	2.225	0.17	1.897	0.079
1250	2.794	0.62	2.980	0.95_5	3.420	2.6	2.590	0.39	2.331	0.21_4	1.994	0.098_6
1225	2.910	0.81	3.115	1.3	3.560	3.6	2.735	0.54	2.450	0.28	2.075	0.12
1200	3.030	1.1	3.260	1.8	3.710	5.1	2.890	0.77_6	2.580	0.38	2.180	0.15
1175	3.160	1.4_5	3.405	2.5_4	3.910	8.1	3.047	1.1	2.715	0.52	2.277	0.19
1150	3.293	1.9_6	3.550	3.5_5	4.140	14	3.210	1.6	2.860	0.72_4	2.375	0.24
1125	3.435	2.7	3.700	5.0	4.430	27	3.380	2.4	3.000	1.0	2.477	0.30

Temp., deg. C	Glass number 12		13		14		15		16		17	
	log η	$\eta \times 10^{-3}$	log η	$\eta \times 10^{-3}$	log η	$\eta \times 10^{-3}$	log η	$\eta \times 10^{-3}$	log η	$\eta \times 10^{-3}$	log η	$\eta \times 10^{-3}$
1100	3.590	3.9	3.850	7.1	4.8	63	3.555	3.6	3.150	1.4	2.580	0.38
1075	3.760	5.7_5	4.000	10			3.750	5.6	3.310	2.0_4		
1050	3.942	8.7_5	4.147	14			3.940	8.7	3.480	3.0		
1025	4.145	14	4.250	18			4.145	14	3.670	4.7		
1000	4.365	23	4.460	29			4.370	23.4	3.880	7.6	3.02	1.0_5
975	4.630	42.6	4.615	41			4.605	40	4.105	13		
950	4.900	79	4.770	59			4.875	75	4.360	23		
925	5.180	150	4.927	84.5			5.170	150	4.630	42.6		
900	5.460	290	5.090	120			5.500	31_6	4.920	83	(3.5)	3.1_6
875	5.760	57_5	5.250	180					5.250	180		
850			5.410	260					5.625	420		
825			5.575	37_6								
800			5.73	540								

Graphic representation of results. Isothermal space models were constructed, showing the variations in viscosity with compn. at temps. of 1500°, 1400°, 1300°, 1200°, 1100°, 1000° and 900°C. The contour lines connect the compns. which have the same value of log η at the given temp., as in Fig. 10. The contour lines were then projected on the triaxial compn. field, giving the Figs. 12–18. The term *isokom* is suggested for identical values of η, *i. e.*, for the glasses having different compns. but the same viscosity at the same temp. *Interpolation from the triaxial diagrams.* The viscosities of a glass as *P* at any given temps. can be obtained by plotting the values of log η against the corresponding values of temp., detd. from the triaxial diagrams. From the curve the value of log η for the temp. in question is read and converted to the antilog, giving the viscosity in poises. *Accuracy and precision of results.* Above 1000 poises the results are probably accurate within 20% and below 1000 poises within 10%. The precision is probably 5% or better. *Influence of dissolved carbon dioxide.* The viscosities of glass No. 9 after being melted in a vacuum furnace until evolution of CO_2 had ceased, were compared with the results obtained on the glass treated in the ordinary manner. The changes in viscosity were within the exptl. error. *Influence of alumina.* 5% of Al_2O_3 was dissolved in glass No. 12, giving it a total content of 6% Al_2O_3. In general the addition of alumina caused an increase in viscosity, the max. increase

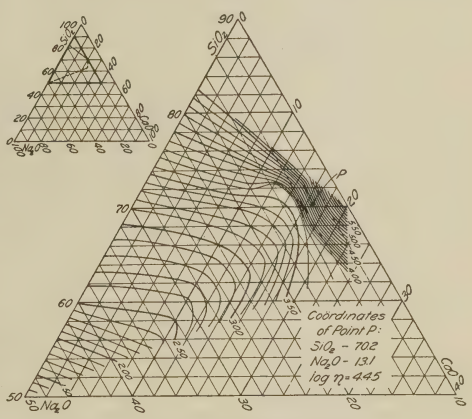


FIG. 14.—Log isokoms at 1100°C.

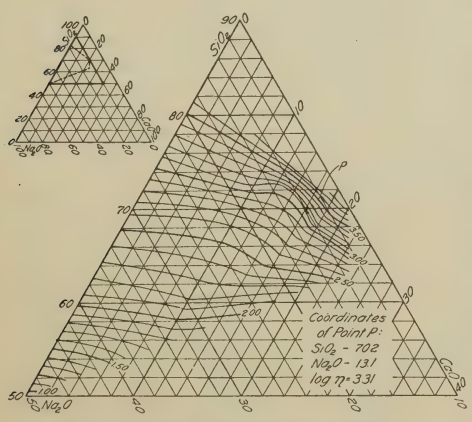


FIG. 15.—Log isokoms at 1200°C.

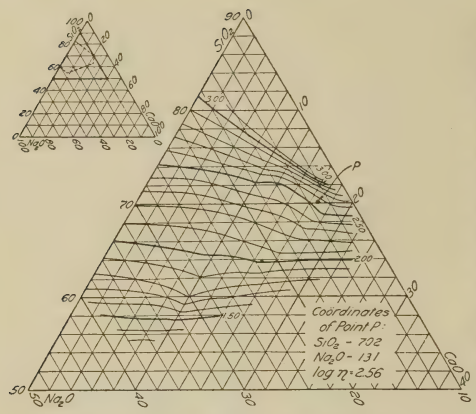


FIG. 16.—Log isokoms at 1300°C.

tained in a platinum wire resistance furnace. The telescope of a cathetometer was focussed on a point at the lower end of the spring and a reading taken. The molten glass was then raised until the surface just touched the lower edge of the cylinder. The cylinder was immediately pulled into the liquid by the capillary forces. At equilibrium another reading was taken. From these readings, the dimensions of the cylinder, the density of the liquid, and the calibration const. of the spring, the surface tension of the liquid was calcd. Assuming that the angle of contact between molten glass and platinum is zero, due to the wetting

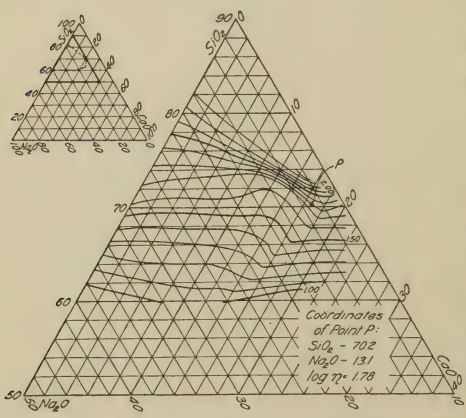


FIG. 18.—Log isokoms at 1500°C.

occurring at 1100°, namely an increase from 4000 poises for the alumina free glass, to 8000 poises for the glass contg. 6%. Towards 1300° and above the increase in viscosity diminishes, and at 960° the viscosity curves cross.

Part II. Surface tensions of glasses at high temperatures. EDWARD W. WASHBURN AND EARL E. LIBMAN. *Ibid.*, pp. 53–71.—*Dipping cylinder method.* Due to the high viscosities of the molten glasses, the only method found to apply was the following modification of Wilhelmy's method. A platinum cylinder suspended on a platinum wire from a Jolly spring was hung above the surface of the molten glass con-

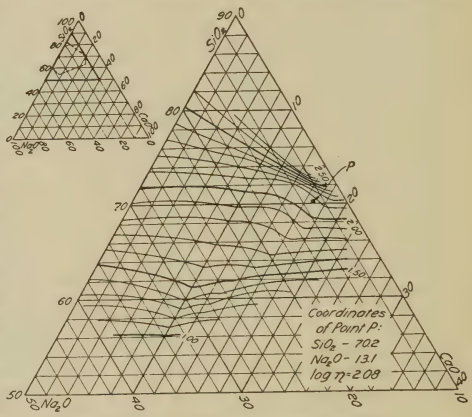


FIG. 17.—Log isokoms at 1400°C.

of the platinum by glass, equation (7) may be simplified to give equation

$$(9):\ \gamma = \left(\frac{kgE}{2L} + \frac{hdgw}{2}\right)\frac{1}{\cos\theta}\ (7);$$

$$\gamma = \left(\frac{k}{2k'L'} + \frac{dw}{2}\right)Eg\ \ (9),$$

where γ is surface tension, k the mass necessary to elongate the spring by a unit quantity, $k'L'$ the true circumference of the cylinder, L' being the measured (apparent) circumference and k' a const. for the metal detd. from equation (9) by calibrating the apparatus with liquids of known surface tension—benzene and water, d the density of the glass, w the thickness of the

cylinder, E the elongation of the spring, h the depth of the cylinder in the glass, and g the acceleration due to gravity. In the present method of operating h is equal to E. Due to the expansion of the platinum at the high temps. a coeff. of linear thermal expansion of 0.00001 was allowed. *Density of glasses at high temperatures.* The data detd. by S. H. Li ("Densities of the Soda Lime Glasses at High Temperature," Bachelor's Thesis, Univ. of Ill., 1922) were used. A solid platinum sphere was substituted for the platinum cylinder, and submerged in the molten glass.

Surface tension of soda-lime-silica glasses. The results are given in Table 24, for surface tension measurements (dynes per cm.) made at two temps., 1206° and 1454°C. Solid models were made to correspond to the data, and *isoepitatic* lines (lines of equal surface tension) were drawn on the model. These lines were then projected on the compn. triaxials giving Figs. 24 and 25.

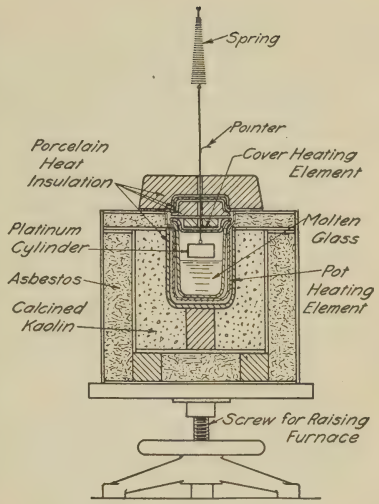


FIG. 22.—Furnace and apparatus for measuring the surface tension of glass at high temperatures.

TABLE 23

DENSITY (IN AIR) OF GLASSES AT 1206°C AND 1454°C

Glass No.	Density, 1206°C	Density, 1454°C
2	2.19	2.15
3	2.42	2.41
4	2.28	2.35
5	2.61	2.59
6	2.46	2.41
7	2.31	2.26
8	2.26	2.20
9	2.26	2.28
10	2.31	2.23
12	2.28	2.23
13	2.31	2.28
15	2.48	2.45
16	2.40	2.43

TABLE 24

SURFACE TENSION READINGS WITH SODA-LIME-SILICA GLASSES

Glass No.	E		Surface tension, dynes per cm.		$-\frac{\Delta\gamma}{\Delta t}$
	1206°C	1454°C	1206°C	1454°C	
2	...	2.438	...	153.7	....
3	2.526	2.296	164.0	148.8	0.061
4	2.442	2.358	156.1	153.6	0.010
5	2.472	2.404	164.1	158.7	0.022
6	2.450	2.422	159.6	128.0	0.013
7	2.339	2.285	150.0	145.9	0.0165
8	2.410	2.212	153.6	140.4	0.054

TABLE 24 (*Continued*)

Glass No.	E 1206°C	E 1454°C	Surface tension, dynes per cm. 1206°C	Surface tension, dynes per cm. 1454°C	$-\frac{\Delta\gamma}{\Delta t}$
9	2.596	2.411	165.4	153.7	0.047
10	2.516	2.452	164.0	156.4	0.031
12	...	2.384	...	151.6	0.030
13	2.552	2.464	166.9	159.4	0.030
15	2.406	2.246	158.7	145.4	0.0546
16	2.319	2.139	150.1	138.6	0.0465

Application of method when density of liquid is not known. After taking the reading A of the cylinder before immersion, and the reading B_1 on immersion in the glass due to surface tension, another reading B_2 is taken after the furnace has been raised or lowered a known amount. In the modified equation (13),

$$d = \frac{\dfrac{2\gamma}{g} - \dfrac{kE}{k'L'(1 + t \times 10^{-5})}}{wh(1 + t \times 10^{-5})},$$

for the reading B_1, $E = h = A - B_1$, for the reading B_2, $E = A - B_2$, and $h = A - B_2 \pm H$ (plus sign if furnace is raised, minus if it is lowered). Substituting these values, and obtaining an equation for each reading B_1 and B_2, and equating them, d is eliminated, giving equation (16): $\gamma =$

$$\frac{\pm k(A - B_1)Hg}{2k'L'(1 + t \times 10^{-5})(B_1 - B_2 \pm H)}.$$

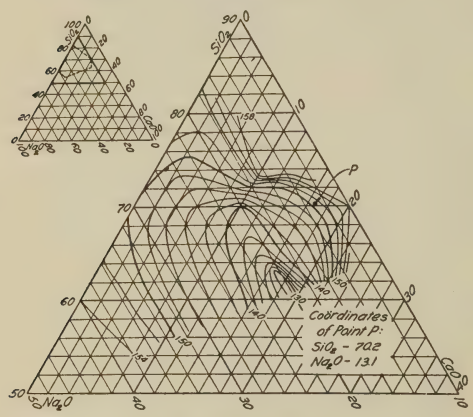


FIG. 24.—Isoepitatic lines at 1454°C.

The results by this method compare favorably with those obtained by the first method. *Temperature coefficient.* The temp. coeffs. are given in the last column of Table 24. They vary between 0.02 and 0.04% per degree C. Surface tension on glass No. 16 was measured at intermediate temps. with the following results: 1454° 137.2, 1397° 140.0, 1356° 143.7, 1314° 146.3, 1289° 148.2, 1248° 149.4, 1206° 150.1. By the use of the temp. coefficients the surface tension of a glass on the triaxial may be approx. computed for any temp. between 1206° and 1454°C.

L. N.

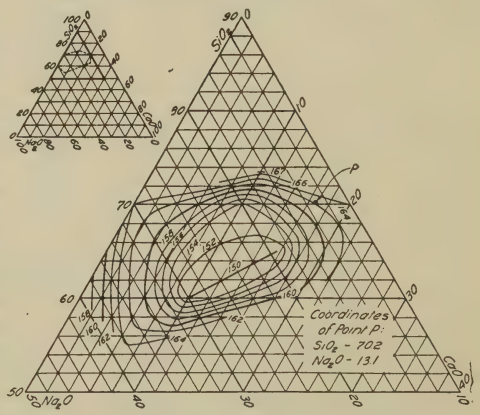


FIG. 25.—Isoepitatic lines at 1206°C.

The use of alumina in glass. R. R. SHIVELY. *The Ceramist*, **4**, 82(1924).—A summary of modern views of the influence of this reagent is given as follows: (1) Reduces the soly. more than lime, (2) Reduces thermal expansion of glass more than lime or magnesia, (3) Alumina aids in preventing devitrification, (4) Reduces

annealing temps., (5) Alumina assists in reducing m. p. in some glasses, (6) Increases luster, (7) Reduces the tendency of soda-lime glasses to scum, (8) Successfully resists failure due to sudden changes in temp. (9) It is reported that it reduces the breaking of ware during finishing. In a number of glasses analyzed it has been found that less than 5% lime combined with 2% alumina, a normal silica content and as much as 20% soda gives a very insol. glass. C. W. P.

The manufacture and uses of fused silica glassware. STAFF ARTICLE. *The Ceramist,* **4,** 41(1924).—A briefly descriptive article of the history of the manuf. of wares of this type and description of the process used. Comparison of the properties of fused silica and hard porcelain is given as follows:

	Fused silica	Hard porcelain
Specific gravity	2.10	2.3–2.5
Tensile strength	Over 700 kg. per sq. cm.	300 kg. per sq. cm.
Resistance to compression	19,800 kg. per sq. cm.	4000 kg. per sq. cm.
Modulus of elasticity	7200 kg. per sq. cm.	8500 kg. per sq. cm.
Average specific heat	.2313 (100°–1600°)	.221 (20°–400°)
Coeff. of expansion	.00000059	.00000380
Heat conductivity	.0026	Over .0025
Melting point	1700°–1800°	About 1670°
Softening point	About 1500°	About 1400°
Elec. resist. at 727°C	400,000 ohms	170,000 ohms
Resist. to penetration	30,000 volts with a thickness of 1.2 mm.	40,000 volts with a thickness of 2.5 mm.
Dielectric constant	3.5–3.6	5.7
Permanency as to weight	High	High
Chem. resist. to H_2SO_4	Absolute	Very high
Chem. resist. against NaOH	Attacked	Attacked slowly
Permeability to ultra violet light	Up to approx. 180 u.u.	....
Hardness	7 according to Mohr	7 according to Mohr

C. W. P.

Quartz glass manufacture. *Nature,* **114,** 516(1924).—(*Physikalische Zeits.,* Aug. 1.) Gives a description of the Herberger method for producing quartz glass for therapeutic and other scien. purposes. This method has been in use for the last 11 years by the firm of Goertz. The finely divided quartz is melted in an elec. fur. in which a vacuum is maintained by continuous pumping until the melting process is complete. The vacuum is then replaced by a gas such as carbonic acid gas under a press. of 8 to 12 atmos., and after a considerable time the fused quartz is allowed to cool. The result is a block of quartz contg. only minute air bubbles in which the air press. is as nearly as possible that of the atmosphere and therefore produces no elastic stresses in the material. According to observations made by G. Joos and described in the same issue, quartz glass made in this way is as transparent in the ultra violet as rock crystal. O. P. R. O.

Equipment for glass pot factory. ANON. *Glass Worker,* **43** [48], 10(1924).—The Ohio Valley Clay Co. of Steubenville, O. installs new equipment. Crusher from the Champion Crusher Co., screens from the Tyler Screen Co., elevators and conveyors from Stephens-Adamson Co., Aurora, Ill. A Dressler tunnel kiln is used for firing and the fired blocks are trued on electrical grinding tables. R. J. M.

Modern methods of glassware decoration. L. KNY. *Glass Worker,* **43** [49], 11 (1924); from Pottery & Glass Trades' Benevolent Institute, England, Mar. 13, 1924.—

Methods of decoration are described including etching, gilding, enameling, glass cameo carving and cased glass. Too much detail to abstract. R. J. M.

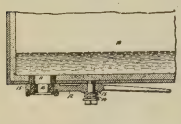
Durability of glass and its importance to the pharmacist. W. E. S. TURNER. *Pharm. J.*, **112,** 264–6(1924).—In a series of 11 samples of soda-lime glass with increasing amts. of CaO, the decrease in soly. upon boiling for 6 hrs. with H_2O, or with 20.24% HCl, or for 3 hrs. with 2 *N* NaOH or 2 *N* Na_2CO_3 is shown in tables and by graph. The usefulness of the *narcotine-HCl reagent* (*C. A.*, **18,** 736; cf. Anneler, *C. A.*, **7,** 2451; **16,** 1294) in detg. the resistance of glass to boiling H_2O is pointed out. S. W. (*C. A.*)

Glass as a raw material in illuminating engineering. ZSCHIMMER. *Glastechn. Ber.*, **1,** 73–6(1923); *Chimie et industrie*, **11,** 930(1924).—An address on the properties and qualities required of glass used for illumination purposes. A. P.-C. (*C. A.*)

PATENTS

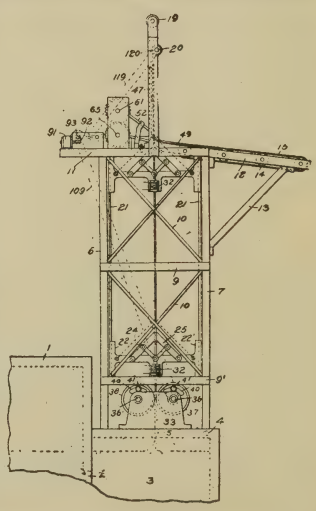
Glass. CHARLES A. KRAUS. U. S. 1,508,455, Sept. 16, 1924. A glass contg. lead oxide and having a coefficient of thermal expansion below about 4.0×10^{-6}.

Glass feeder. CLAUDE W. PLEUKHARP AND HARRY RAYNES. U. S. 1,507,852. Sept. 9, 1924. The combination with a glass feeding vessel having a discharge orifice in its bottom of an arcuate plate having a central handle member and pivotally mounted on the bottom of the vessel and having sliding contact therewith and a series of spigots, each of a different size carried by said plate and adapted to be moved into successive register with the discharge orifice whereby one spigot may be substituted for another, the plate meantime serving to cut off the flow of glass.

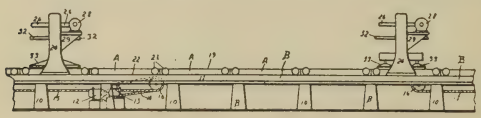


Method of making green scales. WALTER GLAESER. U. S. 1,508,448, Sept. 16, 1924. In a method of producing green scales, the steps which consist in treating calcium citrate with ferric sulphate soln. and then removing the ppt. formed, then adding an ammonium salt removing further ppt., evapg. the filtrate to a strength to produce green scales and brushing the same onto glass.

Apparatus for drawing sheet glass. THOMAS B. CAMPBELL, JR. U. S. 1,508,049, Sept. 9, 1924. A sheet-glass drawing app. comprising a framework, a plurality of vertically reciprocating drawing frames adapted to intermittently grip the sheet being drawn, means for moving the drawing frames upwardly at a uniform and constant speed, means for keeping at least one of said frames reciprocating upwardly at all times, and means for causing said frames to move downwardly at a greater speed than during their upward movement.



Glass-grinding machinery. EDWARD T. BROWN. U. S. 1,508,378, Sept. 9, 1924. In the art of surfacing glass, and wherein the glass sheet is moved in a definite horizontal path beneath a fixedly-positioned instrumentality; a carrier for the glass-sheet and tracks on and between which it moves; a frame supported outside the tracks and extending over the carrier travel path; a surfacing unit mounted in the frame within spaced-apart upper and lower bearings, said unit including a surfacing element operating within the space below the lower bearing, and a shaft for rotating the surfacing element with the shaft mounted in the bearings; means for rotating the



shaft and including a motor supported on the frame and having operating connections with the shaft within the space between said bearings; and unit-supporting and surfacing element positioning means operative to produce controllable gravity-press. of the surfacing element on the sheet, said latter means including a rotatable adjusting element concentric with the shaft and positioned between the motor-operating connections and the lower bearing.

Heavy Clay Products

Mechanical handling equipment in face brick manufacture. G. L. MONTGOMERY. *Chem. Met. Eng.*, **31,** 413–6(1924).—A description of the plant of the Bradford Brick and Tile Co. The shale, shot down with dynamite, is loaded into 5 yd. capacity cars by steam shovels. These cars are hauled to a hopper in the top of the crusher house and automatically dumped. An apron feeder delivers the shale to two single roll crushers in series, from which it is fed onto a belt conveyor, and carried to the top of the grinder house, where it is dumped into bins. From here the crushed mat. is fed by apron feeders to three dry pan grinders, discharged into bucket elevators, which raise the dust to the screening room, and dump it onto "Hummer" screens. The fines pass into a bin while oversize is returned to the grinders. A disk loader beneath the bin delivers the dust to a belt conveyor, which dumps into a bin in the brick making building. Dry press brick, stiff mud brick and flat tile are made, and the machines are fed by belt conveyors. The dry press brick are loaded by hand onto a tunnel kiln car, directly in front of the press. This car is moved by an elec. locomotive to the point where the pusher for the drier takes it. The stiff mud brick are delivered by the cutter to a belt conveyor, from which they are loaded onto tunnel kiln cars by hand. Imperfect brick are left on the belt and dumped onto a return conveyor which returns them to the pug mill. Tile from the tile mach. are piled on Louden overhead carriers. After air drying for 24 hrs., the loaded carriers are moved over above the cars of green stiff mud brick, where a small quantity of tile is loaded on top of each car of brick. The cars are then pushed through the drier and fired in tunnel kilns. The kiln cars are unloaded by hand into carriers on roller conveyors, the carriers are picked up by a monorail crane and unloaded by hand in the store room. M. E. M.

Brick from shale. *Coll. Guardian*, **128,** 768(1924).—The method of mfg. brick from spent shale is first to crush down the shale so that it will all pass, say, a $^1/_4$-in. mesh. The crushed shale is then mixed with about 10% of lime. The 2 are mixed and moistened. They are put under heavy press. in presses designed specif. for this class of brickmaking. The brick, on coming from the press, are strong enough to permit of their being handled and stacked onto wagons. As the wagons are being filled they are placed in long brick tunnels which, when full, are closed up, and steam at atmospheric pressure is turned in. The brick are allowed to remain in the steaming tunnels for about 6 hrs. On withdrawal, they are fit for immediate use. These brick are being largely used in various bldg. schemes and are giving satisfaction. (E. R. Sutcliffe, *Manchester Guardian.*) O. P. R. O.

Makes concrete blocks from brick bats. ANON. *Brick & Clay Rec.*, **65**]5], 313 (1924).—A well-known manufacturer of face and paving brick in the central West found by expt. that concrete blocks made from crushed brick aggregate were economical to manuf. and salable. The bats are crushed in a jaw crusher, and screened, the tailings being returned to a pulverizer. Only 6 or 7% of the resulting aggregate is retained in a $^3/_8$" screen and all passes $^1/_2$". One part cement and 7 parts aggregate are mixed for 5 mins. in a batch mixer on top of an automatic concrete block mach. The blocks are steam cured in tunnels at 100°F for 36 to 48 hrs. They are then sprinkled for 2 or 3 days in the storage yard and in 10 days are ready for the market. P. D. H.

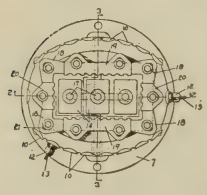
$2700 started this tile producer. ANON. *Brick & Clay Rec.*, **65** [5], 319(1924).—

A novel feature of this plant is a monorail sliding door which has been developed for the fire box openings of the down-draft kilns. The door is composed of a fire-clay slab supported by metal hangers which in turn are attached to rollers that run on a curved rail above the fire boxes. The door is very easily operated and can be kept open any desired distance. P. D. H.

BOOK

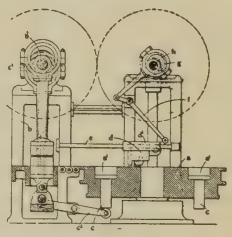
Adaptability of Tile to Hospital Requirements. CARL H. GEISTER (Industrial Fellow, Mellon Institute). Requisite properties of floor tile for hospital use are: resist. to abrasion, to absorption, to staining, to indenture, to heat and to chemicals, as well as a high coeff. of frictional resist. Of special note was the abrasion test. A leather faced wheel revolving against the tile duplicating as near as possible the wear of walking. Other tests were run in the usual manner. Some of the mat. tested were vitreous, semi-vitreous, glazed and rough paving tile, rubbers, linoleums, corks, magnesite compns., asphaltic compns. and marble aggregates. Of these mats., vitreous tile are the only ones not showing some absorption, ranking at the top in the abrasion test, the only group to get an "A" rating in both resistance to chem. and for non-staining qualities; also perfect in ht. resist. Vitreous tile showed no indentation when subjected to press. on a small area, yet show a high frictional resistance against slippage. From all tests conducted, vitreous tile lead in desirable qualities for hospital use. I. A. K.

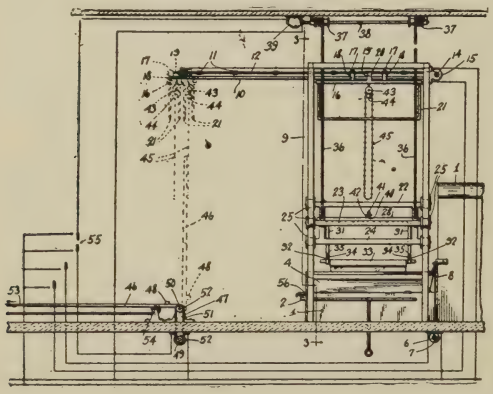
PATENTS



Clay-forming die. DAVIS BROWN. U. S. 1,508,773, Sept. 16, 1924. In a clay forming die, a former, a finisher formed of corner and side sections, and means for adjustably securing the sections relative to the former and to each other.

Brickmaking and like press. THOMAS STANLEY. U. S. 1,510,349, Sept. 30, 1924. In a brickmaking press having a rotary mold table, a pusher horizontally reciprocated above the said table for transferring the blocks of molded material from the said table, said pusher comprising an oil receptacle, a plurality of openings through the bottom of the said receptacle, wicks inserted into said openings and means for supporting the pusher above the table so that the wicks are maintained in contact therewith.

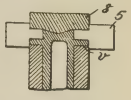


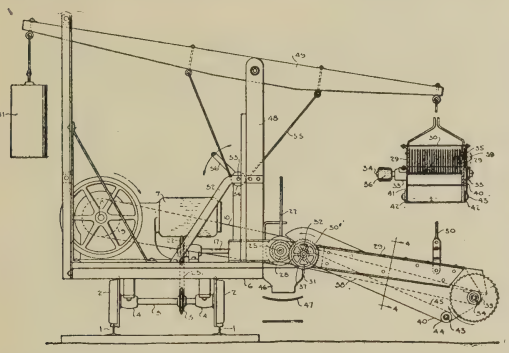


Glass-drawing apparatus. DAVID L. SWINDELL. U. S. 1,509,183, Sept. 23, 1924. An app. of the class described comprising a straight bait bar, a vertically movable carriage, a supporting frame for the bait bar removably supported in the carriage a horizontally movable carriage, means thereon for automatically engaging the supporting frame when the vertically movable carriage brings said frame adjacent the horizontally movable carriage and means for moving said carriages.

Process for the manufacture of hollow brick closed on all sides. HANS TREITEL. U. S. 1,507,219, Sept. 2, 1924. A process for the manuf. of hollow brick closed on all sides consisting in a hollow brick being first pressed with an open end

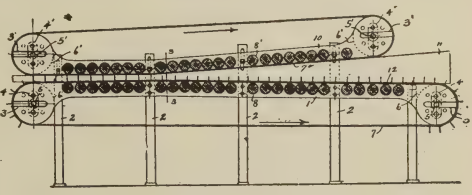
and burrs of suitable thickness on two opposite walls and then pressing the burrs toward one another thereby forming a closed end having the desired cross-sectional dimensions. A device for the manuf. of hollow brick closed on all sides consisting in combination of a mold, lateral spaces thereon, said mold and spaces being adapted to be filled with plastic mat., a press ram or plunger adapted to press the hollow brick within said mold and spaces with an open end and thickened walls and press-members adapted to press the projecting thickened parts of the walls toward one another after the plunger is withdrawn, for the purpose of closing the open end of the brick.





Clay-digging machine. JAMES T. POKORNY. U. S. 1,509,173, Sept. 23, 1924. A device of the character described including a framework, a boom pivoted thereto at one end, a gang of pulverizing saws rotatably mounted at the free end of said boom, a digging saw spaced from said pulverizing saws, an operative mechanism carried by the framework through which said saws may be driven, means for elevating and lowering the same, depending side plates carried by the boom, an endless belt moving between the side plates, said belt and plates forming a conveyor disposed to receive from said saws.

Brick-molding machine. JAMES T. POKORNY. U. S. 1,509,174, Sept. 23, 1924. In a molding mach., an endless belt, rollers over which the same operates, a series of molds carried by said belt, said rollers having peripheral ribs and grooves, the ribs of each roller fitting into the grooves of adjacent rollers. In a molding mach., an endless belt, rollers over which the same operates and a series of molds carried by said belt and formed of slightly flexible mat.



Refractories

Novel experiments in casting huge glass pots prove successful. ANON. *Ceram. Indus.*, **3** [3], 186(1924).—The U. S. Bur. of Stand. recently completed the drying of three exptl. pots having outside dimensions of 3 ft. 6 in. in height, 4 ft. 9 in. in diam. and a max. wall thickness of 5 in. 10 T. of plaster were used in making the mold. The equipment available necessitated mixing and pouring 8 batches of 300 lbs. of plaster each in the casting of a single section of the mold. Since the various sections had to be turned to the proper shape it was necessary for the set of the batches of plaster slip to be retarded progressively by the addn. of decreasing amts. of an organic retarder. The mold was cast and turned to shape on a surfacing wheel which functioned as a turning wheel. $1^1/_2$ T. of slip were required to cast one pot and no particular difficulty was experienced in this phase of the work. A satisfactory body compn. is as follows:

Body	%	Grog	%
Feldspar	4.0	Tenn. ball	50
Tenn. ball 5	16.0	Calcined to cone 10.	
Ky. ball 4	9.0	N. C. kaolin	50
N. C. kaolin	12.0	Calcined to cone 10.	
Del. kaolin	4.5	Grog Sizing:	
Ga. kaolin	4.5	10–20-mesh	20
Flint	...	20–40-mesh	50
Grog	50.0	Through 40-mesh	30

P. D. H.

Saving the surface of refractories by using a refractory coating. H. M. CHRISTMAN. *The Ceramist*, **4**, 107(1924).—A refrac. coating is not identical with refrac. cement. It is proposed to apply a superficial coating which will reduce the erosion and corrosion of refrac. Neither compn. nor data are given. C. W. P.

Some aspects of the industrial application of refractories. M. C. BOOZE. *The Ceramist*, 243(1923–4).—A résumé of the charac. and uses of the principal types of refrac. C. W. P.

The true specific gravity and after-expansion of lime-bonded silica brick. W. J. REES. *Jour. Soc. Chem. Ind.*, **43**, 986(1924).—(Meeting of English Ceramic Society, Sept. 18 and 19.) Data are given in a graph and table for 40 brick from Great Britain and France. There is a close relation for brick contg. 1–3% lime, between powder density and the extent of quartz conversion. There is a close reln. for brick of fine and medium texture, but not for brick contg. fragments of $^1/_4$ in. or more in diam. between powder density and after-expansion as detd. by the standard after-expansion test. The powder density may, therefore, be used as an indication of the permanent vol. change which is likely to occur during use. The grading of raw mat. has greater influence on the rate of quartz conversion than variation in the source or type of the raw mat. itself. H. H. S.

The storage of silica refractories. W. J. REES. *Jour. Soc. Chem. Ind.*, **43**, 986 (1924).—(Meeting of English Ceramic Society, Sept. 18 and 19.) Silica brick which had been kept in the open for 6 mos. spalled badly in use, while new brick of the same make, texture, and sp. gr. were satisfactory. The good brick had a cold crushing strength of 3000 lb. per sq. in. while the stored brick had a strength of only 2200 lb. per sq. in. It is found that loss in strength by exposure is in part due to a slight loosening of the bond by hydration and soln. in water, as well as to the phys. effect of frequent wetting and drying. These tests showed little or no distinction between coarse and fine textured brick, but in both cases the brick fired at higher temps. were more resist. to action by water. H. H. S.

The influence of exposure on the chemical and physical properties of certain fire clays. W. HUGILL AND W. J. REES. *Jour. Soc. Chem. Ind.*, **43**, 985(1924).—(Meeting of English Ceramic Society, Sept. 18 and 19.) Samples of 3 clays, 2 of them sandy and micaceous, the other fine-grained and more aluminous, were spread evenly over the bottoms of wooden boxes and exposed to the weather for 12 mos. Small brick were made from the exposed and unexposed samples. Exposure improved the working properties of the siliceous clays, but not materially the aluminous clay, though some impurities were removed. Bacteria seem to promote the decompn. of sulphides in clays, and possibly such decompn. may be accelerated by inoculations. H. H. S.

Some properties of clay-sillimanite mixtures. H. S. HOULDSWORTH. *Jour. Soc. Chem. Ind.*, **43**, 985(1924).—(Meeting of English Ceramic Society, Sept. 18 and 19.) The commercial sillimanite used contd. 32.9% silica, 64% Al_2O_3, with Fe_2O_3 and TiO_2. The grading ranged from 11.8% of mat. between 5-mesh and 10-mesh through inter-

mediate grades to 18% of mat. through 200-mesh sieve. Results are summarized thus: Addition of sillimanite to clay decreases drying and burning shrinkages, increases porosity, and when 50% or more is present, increases refractoriness appreciably. A mixt. of 95% sillimanite with 5% ball clay has a regular coeff. expansion from 15° to 1000°. The rapid expansions of fire clays between 100 and 200°C, and 500 and 600°C, are reduced by the addn. of sillimanite. Chemical attack by soda-lime glasses and basic slag is less on mixt. contg. more than 50% sillimanite than on fire clay or mixt. with less sillimanite than 50%. Sillimanite bonded with 10 g. ball clay is markedly resistant to chem. attack. H. H. S.

Whitewares

The effect of the fineness of grain of flint and feldspar. G. H. Brown. *The Ceramist,* **4,** 29(1924).—Investigation was made on the influence of fine grinding of flint and feldspar upon a body of the following compn.: Fla. kaolin, 35%; feldspar, 35%; flint, 30%. The bodies were fired to cone 10 and porosity detd. Also the comparative effects of ball-mill grinding versus blunging bodies of the same compn. which were subsequently fired at cone 10. Results obtained were as follows: The body ground in a ball mill had a porosity of 4.96%, while the same body blunged for a similar period of time had a porosity of 9%. Results are summarized as follows: (1) The fineness of grain of commercial flints, prepd. under the same condition, is dependent somewhat upon the nature of the raw mat. from which they are produced. (2) Increased vitrification of a vitreous body may be secured by the use of more finely ground flint. (3) Increased vitrification of a vitreous body may be secured by the use of more finely ground feldspar. (4) The use of finely ground flint and feldspar in a body is conducive to some of the increase in vitrification secured by wet-grinding the flint and feldspar content of bodies in ball mills. (5) The substitution of a finely ground flint for a coarser product permits the use of a higher total flint content in a body. (6) Difficulties from cracking or "dunting" of vitreous bodies may be lessened by the use of a more finely ground flint or of a small propn. of extremely finely ground flint.

C. W. P.

The china ware and porcelain industries in Germany. F. J. M. Koenig. *The Ceramist,* 269(1923–4).—Historical and statistical, with brief reference to typical compn. of hard and soft porcelain. The compn. of the so-called "light ware" which is still in use is approx. as follows: Refractory clay 25%, kaolin of Halle 30%, quartz or flint 35%, calcium carbonate 10%. The bisque is fired to about cone 3, and a glaze of the character as noted below is used, this melting occurring at cone 07:

$$\left.\begin{array}{l} 0.10\ K_2O \\ 0.20\ Na_2O \\ 0.38\ CaO \\ 0.32\ PbO \end{array}\right\} 0.28\ Al_2O_3 \left\{\begin{array}{l} 2.5\ SiO_2 \\ 0.4\ B_2O_3 \end{array}\right.$$

Mfg. of semi-vitreous, table, toilet and sanitary ware is growing extensively. This being produced with a hard (?) glaze, fired from cone 04 to cone 2. The indus. is centered on the Rhine River. Its importance is small as compared with the porcelain indus. Continuous decorating kilns are used in about 50% of the potteries.

C. W. P.

BOOK

Lenox China. The Story of Walter Scott Lenox. George Sanford Holmes. This booklet gives in an interesting manner the life story of Walter Scott Lenox, and the history and development of the Lenox Pottery. Their process of making china is described in a non-technical manner. The booklet is well illustrated. H. G. F.

Chemical stoneware. F. A. WHITAKER. *The Ceramist,* **4,** 70(1924).—The body is a selected blend of plastic close firing stoneware clay to which a small amt. of feldspar and grit are added. The clays are previously washed, blunged and filter-pressed at a pressure of 250 lbs. per sq. in. Non-plastic mats. are added and the mixt. is passed through horizontal pug mill. The prepd. clay is aged in cellars. Circular pieces up to 7 ft. in diam. are jiggered in plaster molds. Piping is manufd. by extruding plastic clay through bronze die. The assembling of parts for complicated pieces requires a remarkable nicety of judgment in order to insure the avoidance of strains in drying and firing. The drying of simple pieces is done over steam coils or in chambers heated with waste heat from kilns. Larger and more complicated pieces are put through special drying chambers where heat and humidity are carefully controlled. Ware is fired in a rectangular down-draft open-fire kiln of special design. These measure 45 x 14 ft. inside and are furnished with 6 horizontal grate furnaces on each side. Gas coal is used as fuel. Time of burn av. about 86 hours. Pieces of all sizes and thickness from $^1/_8''$ to 6″ are fired together in the same kiln. The ware is salted to develop a glaze. Interior surface may be coated with slip or loam glaze. The fitting and assembling of complicated pieces such as exhaust fans, centrifugal pumps, etc., necessitates accurate machining of the individual units after firing. This is done by special designed grinding tools. The total shrinkage of the ware during the process of manuf. is in some cases as high as 2″ to the ft. All finished ware is subjected to finer inspection and test. C. W. P.

Conditions in Saxon porcelain industry. A report of the Vice-Consul, C. T. STEGER, furnished by the Bureau of Foreign and Domestic Commerce. *The Ceramist,* 275 (1923–4).—General unfavorable situation in Saxony due to the decline of the value of the mark. The domestic demand is only for cheaper grades. Coarser products are increasing rapidly. C. W. P.

Equipment and Apparatus

The use of auxiliary or portable fans for watersmoking. ANON. *Brick & Clay Rec.,* **65** [5], 327(1924).—Portable fans are being used to great advantage to hasten watersmoking and cooling of kilns. An illustration shows a fan being used in a slightly different manner, in that it is connected to a kiln stack by a sewer pipe connection set in the stack wall at an angle of about 45°. The firing time has been reduced from $8^1/_2$ to 5 days. P. D. H.

Facts on the problem of electrification. JAMES R. DOWNS. *Brick & Clay Rec.,* **65** [5], 323(1924).—The greatest hindrance to a rapid change from present methods to elec. drive is apparently the lack of accurate information on the power requirements of the different machines. A 10 ft. dry pan in a given plant requires 32 h. p. whereas the same sized pan in another plant grinding the same class of mat. requires from 75 to 100 h. p. depending upon the variation in the amt. and condition of the mat. in the pans; d. c. motors should not be installed in clay plants. While the a. c. motor is the more desirable, the standard general purpose squirrel-cage type is not as satisfactory as that known as the high torque motor. Bearings should be made dust-proof and motor driving pans, pug mills and brick machines should be of the three bearing type, that is, with outboard bearing and sub-base, to provide for heavy overloads. Individual motor drive is more satisfactory than group motor drive, as friction losses in the latter average about 35% and the former greatly facilitates repairs. Speed regulation is very important to secure uniform production. The cost of power varies from $1.50 per M brick in the ganister district to $.94 per M on a plant using hard shale making face brick in the Pittsburgh district. A list of the equipment used in this plant is

given including the various sized motors. A table also gives a complete chart of production, power consumption and costs over a 12-mo. period. P. D. H.

Removing ashes from radiated heat drier. HAROLD COPPING. *Brick & Clay Rec.*, **65** [1], 42(1924).—The device described is C.'s own idea. A very complete sketch accompanies the article. The equipment consists of a light overhead track rail extending the full length of the fireman's pit and suspended from the timbers or I-beams spanning the pit and upon which the drier tracks rest, a trolley and a specially constructed bottom dumping bucket. Above the pit and over the "cooling tracks" is a short length of track (about 20 ft.) hung at right angles to the pit and upon which a "hay carrier" operates. A small hand windlass attached to a post against the wall in the pit completes the outfit. The ash bucket has a capacity of about 20 cu. ft. and the bail is of such length as to place the bucket at a convenient shovelling height thus eliminating the necessity for a chain hoist. The bucket upon being filled is moved along the trolley to the point beneath the "hay carrier" track, where the cable is hooked onto the bail and by means of the windlass, the bucket is elevated and run out over a wagon, thus disposing of the ashes with one shovelling. P. D. H.

A few hints on clay plant hauling equipment. B. F. TOWNSLEY. *Brick & Clay Rec.*, **65** [1], 30(1924).—The particular type of mechanical haulage for a given plant depends on local conditions. Rope haulage should be employed in plants where the pit is located near by and the grade is above $2^1/_2$%. If less than $2^1/_2$% other methods may be resorted to with a possible saving. A 1% grade takes almost double the energy that is necessary to move a load on a level track. In general practice, the haulage capacity of a locomotive is 13 T. per ton of locomotive weight, on the level, while with a 1% grade this is reduced to 8 T. and with a 5% grade to 3 T. The gasoline or elec. type of locomotive is generally preferred to steam. The advantages of the former are its low first cost, which is about $750 per T., its simplicity of opern. and normal fuel consumption cost of about $1.00 per T. weight per day. This type would accordingly be desirable in plants where requirements are for a less-than-three-ton locomotive. Elec. locomotives propelled by storage batteries offer a reliable, flexible and economical source of power. The first cost per T. wt. is about $1400 and the cost to operate is about 10c per T. per day, and often less as the batteries are charged at night during the off-peak load of the plant. The proper size and type of car is another important factor. Standard practice dictates the use of the V-bottom, steel, side dump cars, where, in many instances, more efficient types could be used. Storage battery trucks are now being used for coal distribution, ash removal and green and fired ware transportation. Portable platforms facilitate the movement of ware. A truck of this type with one man can equal the capacity of from 5 to 10 men with wheelbarrows. P. D. H.

Development in dry pan construction. P. B. REED. *Brick & Clay Rec.*, **65** [5], 322(1924).—The rate of output of a dry pan depends much more upon the design and location of the mullers than upon the screen plate area. An older type of 9 ft. pan had 12 in. by 54 in. mullers, each having a wt. of 7429 lbs. The width of the screen plates was 18 in. and the grinding area in one revolution was 3419 sq. in. The diameter of the newer type of pan was reduced from 9 ft. to 8 ft. 6 in. by taking 3 in. off of the outside of the screen plates. The mullers were moved out 3 in. thus taking 2 in. off the inside of the screen plates. The dimensions of the mullers were $14^1/_2$ in. by 55 in. each having a wt. of 9301 lbs. The width of the screen plates was 12 in. and the grinding area in one revolution was 5938 sq. in. It was also found that wider slots in the screen plates produced more fines. The $^1/_{16}$ in. perforations were replaced with openings from $^1/_4$ in. to $^1/_2$ in. and even larger, the limit being when too great a load is placed on the elevator and screen due to too large a percentage of tailings being returned to the

pan. By selecting the correct screen openings the new 8 ft. 6 in. pan will grind from 40 to 50 T. of 12- to 14-mesh hard fire clay dust per hr. P. D. H.

Things to remember when you buy belts. E. H. Cole. *Brick & Clay Rec.*, **65** [5], 326(1924).—Care should be taken in choosing the proper type of belt for the purpose intended. The size is also very important. When changing pulleys, the width should always be increased where possible, as this increases the area of belt contact with the pulley without increased thickness of belt. The pulleys should be kept as large in diameter as possible as it is most destructive to a belt to run over small pulleys. A new belt should be run slowly until it has adjusted itself to the stresses. Belts should be kept pliable by the use of a good belt dressing. Rosin is very undesirable. In joining a belt, laboratory tests have shown that a fastener which is designed to secure a firm hold on the threads of the belt is more satisfactory than rawhide lacing.

P. D. H.

The formation of kaolin at moderate depths. A. L. Parsons. *Am. Mineral.*, **8**, 157–62(1923).—The feldspars and feldspathoids are the principal minerals from which kaolin may be formed. Carbonic acid is regarded responsible for most of the kaolinization of surface deposits. In a kaolinized dike at the Helen Fe mine (Ont.) CO_2 was liberated by the oxidation of a large body of siderite, the Fe forming goethite. The source of CO_2 in the kaolin deposits at Huberdeau, Que., was probably a cryst. limestone sepd. from the kaolinized granite and gneiss by a shattered quartzite.

E. F. H. (*C. A.*)

Drying. Industrial drying. The apparatus and how it works. Lucien Buck. *Chem. Met. Eng.*, **29**, 626–31(1923).—The general principles of drying with air are set forth. There is a limit to the speed at which any material can be dried. If this limiting speed is exceeded, injury such as checking, warping, cracking, etc., usually results. Suggestions are made to designers of driers. Heat insulation is discussed. Driers are classified and as an example data are given and calcns. made for a drier for coco fiber mats. E. R. G. A. (*C. A.*)

Self-cleaning continuous filter. Anon. *Chem. Met. Eng.*, **29**, 1193–4(1923).—1 illus. The ideal condition for filtration would be: (1) filtering performed by the solid matter in the liquid filtered; (2) the layer of this solid matter must be constantly removed without exposing the bare surface of the screen or filtering device; (3) the solid material should leave the filter with but a small % of moisture—dry if possible. The upper part of the filter consists of a cylinder ending in a short cone resting on bars placed radially inside of a shell, which rests on a saddle, permitting the escape of the filtrate into a surrounding basin. The saddle supports the bars and its central hole corresponds with a hole in the center of the basin, and is closed by a conical plug operated by hydraulic pressure. The displacement center is continued upward into the mixer in which a reciprocating plunger passes up and down into the upper cylinder to the beginning of the short cone. The functioning is explained. The design allows employment of any pressure that the shell will stand, the bars cannot become distorted, and there is complete absence of screens, cloth, and moving parts. W. H. B. (*C. A.*)

Fine screening equipment—its selection and operation. F. S. Curtis. *Chem. Met. Eng.*, **29**, 759(1923).—Screening equipment must be adjustable. Specifications stated in fractions of an inch instead of in "mesh" become more definite and dependable. The use of a screen in closed circuit with grinding equipment increases the output without increasing the power requirement. W. H. B. (*C. A.*)

Equipment for difficult screening. L. H. Sturtevent. *Chem. Met. Eng.*, **29**, 1063(1923).—A description of the vibrating screen is given, pointing out its applications and advantages. L. A. P. (*C. A.*)

Fuel oil viscometers. W. H. Herschel. *Chem. Met. Eng.*, **26**, 1175(1922).—

After making the Couette correction (0.311 × diam.) and the kinetic energy correction coeff. (1.128) the equation for the normal Saybolt Furol viscometer is *kinematic viscosity* $= 0.0220t-(2.03/t)$. The corresponding equation for the Redwood Admiralty viscometer is *kinematic viscosity* $= 0.0239t-(0.403/t)$. By using the equation for the Saybolt Universal viscometer, *kinematic viscosity* $= 0.00220t-(1.80/t)$. With the above, H. calcs. tables for conversion of time Saybolt Furol to Universal and Redwood Admiralty. E. C. B. (*C. A.*)

A simple thermoregulator for use with gas burners. Fr. Viktorin. *Mikrokosmos*, **17,** 138–9(1924).—A simple and inexpensive thermoregulator for the control of thermostat or incubator temps. is made in a test-tube. A cork contg. a 3 mm. internal diam. glass tube extending 4 cm. upward from the cork is fastened inside the test-tube about 5 cm. from the bottom. Hg fills the bottom of the test-tube and rises to the middle of the 3 mm. glass tube. The inlet tube leading from the illuminating gas supply passes through a cork in the top of the test-tube. The inner end is drawn to a long capillary and is cut off at an acute angle. The opening thus formed is adjusted at the proper height inside the 3 mm. tube so that expansion or contraction of the Hg automatically acts to diminish or increase the size of the opening. The illuminating gas is conducted from the thermoregulator to the burner by means of an exit tube through the upper cork. The test-tube regulator is installed in the thermostat or incubator. Minute details of construction are given. R. L. D. (*C. A.*)

Kilns, Furnaces, Fuels and Combustion

Rectangular kiln bracing. Wm. Burgess. *The Clay Worker*, **81** [7], 669(1924).—One foot rise to each four ft. of width gives the longest life to kiln crowns. The crown should be built in sections to facilitate repairs. Kiln crowns have lasted 12 to 14 yrs. without renewing any part. One section 35 ft. in length lasted 16 yrs. without repairs. There should be as few flues as possible in the main walls. Half circle arches on rectangular kilns are not satisfactory as they are sure to bulge on the quarters or one side will rise and let the other side flatten. The best crown is made of wedge brick to properly fit the circle. As this would require special brick, wedge brick alternating with standards are satisfactory. Crowns should not be built with all standard brick with heavy mortar to keep the bed joint radial. A single 10-in. I-beam has been found stronger and cheaper than the old type of rod-braced double rail brick stay. The tie rods should be secured with forged loops over the I-beams. Each tie rod across the kiln should be provided with a turnbuckle and 2 or more should be used in the rods running lengthwise. Two runs of 60-lb. railroad iron should be placed around each kiln, one a little above the fur. arch and the other directly behind the skewback on the sides of the kiln. They should be fishplated together and placed close to the buck stay, on the ends of the kiln on the same level as the sides, one coming about half way down on each side of the wicket opening and the other one just over the top of the wicket arch. Expansion joints should be provided between the floor brick and the kiln wall. The lining should be thoroughly bonded to the main wall. The backing-up brick should not be loosely laid. Brick chips when used to loosely fill the voids will wedge down into the crevices and cause "crowding" as the wall contracts and expands. P. D. H.

A comparison of gas- and coke-fired drying stoves. T. W. Barley. *Jour. Soc. Chem. Ind.*, **43,** 985(1924).—(Meeting of English Ceramic Society, Sept. 18 and 19.) City gas was used for drying large molds in steel works until post-war conditions made it too expensive. It was substituted by the Hüttenes coke-fired, air-blown fur., which with minor modifications has been found very satisfactory. The hot gases are met by a pre-htd. jet of compressed air at 80 lb. per sq. in. press. the products of combustion

being thus projected into the drying chamber at a high velocity. All molds are thoroughly dried at the end of 15 hrs. no mold being found burned or imperfectly dried. The av. working temp. for mold drying is 225°C, for large cores 200°C, and for small cores 180°C. H. H. S.

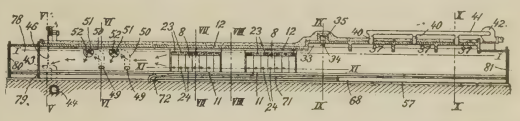
American furnaces for the treatment of iron and steel. BRUNO SCHAPIRA. *Feuerungstechnik*, **12** [21, 22, 23], 174, 184, 189(1924).—Describes in detail the function and different types of such furnaces and discusses the importance of the correct selection of refrac. for lining same. For the crown of the Martin fur. acid (silica) brick are used and for the hearth either an acid or a basic (magnesite) brick depending upon the conditions. The author refers to the research work being undertaken at this time by the Refractory Mfrs.' Assoc., etc., to bring about the following improvement in their product. (1) The manuf. of a more even product by keeping close check on raw mat., substituting dry grinding and screening for wet, close control of water content, (2) raising m. p. by adding new mat. with a m. p. 100° to 160°C higher than the best refrac. used to date, (3) increased resist. to temp. variations through larger use of calcined clays, control of grinding, improved methods of molding and use of better quality clays, (4) min. change in volume through use of brick fired at high temp. in elec. fur. and by using special raw mat., (5) resistance to action of slags. Several newer raw mat. of high refractoriness are mentioned, (*a*) Missouri diaspore which melts at cone 40 and is dense and slag resisting, (*b*) Calif. periclase, a cryst. oxide of magnesium, (*c*) spinel, (*d*) sillimanite, (*e*) fused silica. F. A. W.

Operation of the Shaw gas kiln. LEROY H. MINTON. *The Ceramist*, **4**, 15(1924).—A compartment kiln for finer grades of ware. Twenty-five are operg. and being built in England, 2 or 3 in France, and 2 are in use and 1 being built in the U. S. The kiln is used for all types of ware, excepting those requiring salt glazing. The kiln normally consists of 16 chambers, usually placed in 2 rows of 8 each with passageways between, the whole occupying an area of 100 ft. x 61 ft. The compartments have a setting space of 7 ft. x 23 ft. x 8 ft. The kiln is fired from gas produced from coal. A saving of 50–80% fuel over that required in periodic kilns is claimed. Fuel consumption of kilns now fired in England is given as follows: fire brick to cone 10 = 350 lbs. of coal per 1000 brick; glazed brick to cone 10 = 675 lbs. of coal per 1000 brick; architectural terra cotta to cone 6–7 = 19 tons of coal for 17 tons terra cotta per week. Comparison of fuel consumption of the Shaw kiln with periodical muffle kilns: for the muffle kilns the av. coal per kiln fired was 23.26 T. For the gas kiln the av. was 3.36 T. This is equiv. to 6.72 T. for a muffle kiln on the basis of output. On a direct comparison this shows the saving to be 72% of the coal required for periodic kilns. It is possible to fire different kinds of ware maturing at different temps. in different chambers. It is also possible to regulate the atmos. of the firing chamber so as to fire glazed ware without the use of muffle or saggers. The following results have been attained in this country: Vitreous sanitary ware, glost firing, 2.6 T. per coal per chamber containing 240 closet bowls or 300 tanks. Fire clay sanitary ware required 3.36 T. of coal per chamber containing 10 T. of ware and $7^1/_2$ T. of fixtures fired to temp. of cone 9 down. Advantages claimed for the kiln are: (1) Saving of 50–80% fuel over periodic kiln. (2) Lower operg. cost. No coal or ashes to be carted in and out, or to block the kiln room. (3) Ease of operation. Perfect control at all times. One man can handle gas producer and kiln. (4) Lower labor costs. A kiln occupying 100 ft. x 61 ft. has a capacity equal to periodical kilns occupying 350 ft. x 40 ft. All labor of conveying ware is greatly reduced. No night loading is required as for tunnel kilns. (5) Compactness. Comparison with the Shaw kiln 100 ft. x 61 ft. with a tunnel kiln 350 ft. to 450 ft. long makes it evident to any engineer which is better adapted to fit in with modern factory design. This is a very important point for plants already built. (6)

Greater flexibility. Chambers may be set with wares requiring different maturing temp. This is impossible in any tunnel kiln. (7) Ease of repairing. Kiln does not require stopping operations for any except major repairs. (8) Quality and cost. Produces highest percentage of quality ware at the least cost per unit. This is a final argument for any comparison. C. W. P.

PATENT

Tunnel kiln. CONRAD DRESSLER. U. S. 1,509,195, Sept. 23, 1924. A tunnel kiln comprising a main chamber through which the goods to be treated are moved, means situated approx. at the center of said chamber for developing a high temp. therein, and gas propelling mechanism located within the kiln and associated with the forward heating zone of said main chamber and adapted by its propulsion to equalize the ht. distribution in said zone.



Geology

New uses of non-metallic minerals. W. M. MYERS. *The Ceramist*, **4**, 99(1924).—The compn., occurrence, properties and uses of the following minerals are described: The andalusite group, beryl, spinel, and bentonite. (1) *Andalusite* occurs in a deposit of commercial importance in Mono County, Calif. It is so pure that no other treatment than crushing is necessary. The ore is transported by mule trains and wagon to the railroad and shipped to Detroit. Production at present amts. to 70 T. a week. At the pottery it is crushed in Blake jaw crusher, then milled in a Hardinge ball mill, passed over a Dings magnetic separator to remove the abraded iron and finally ground in a Hardinge pebble mill lined with special sillimanite porcelain and using balls of the same material to avoid contamination. The finely ground andalusite is mixed with other porcelain making mat. and ground wet to pass 300-mesh screen. The resulting batch is molded and fired at such a temp. that the andalusite inverts to sillimanite. (2) *Cyanite* occurs in deposits of commercial importance in Wyo. and Va. Commercial possibilities are not fully known. It inverts to sillimanite when heated to sufficiently high temps. (3) *Sillimanite*. The only known large deposits occur in India. (4) *Beryl*. The annual production does not exceed 10 T. It is found associated with feldspar and mica. Small amts. are shipped to Germany for use in the manuf. of beryllium salts and metal beryllium which is said to be used in the prepn. of certain alloys. (5) *Spinel* has been found in many scattered localities, but not in sufficient quantity to be of importance. Synthetic spinel is made by combination of magnesium oxide and alumina from the mineral alumite. (6) *Bentonite* and *Montmorillonite*. The two are so similar that it is practically impossible to distinguish between the same. C. W. P.

Bauxite. J. T. FULLER. *Chem. Bull.* (Chicago), **11**, No. 2, 31(Feb., 1924).—General article. J. J. H., JR. (*C. A.*)

Chemistry and Physics

Preparation of alkali silicate from calcined infusorial earth. E. KLEINSCHMIDT AND F. STEINBERG. Ger. 369,062, *Oil & Col. Trade Jour.*, **66**, 1052(1924).—Infusorial earth, calcined out of contact with air, is treated with dissolved alkali, a clear, colorless soln. of alkali silicate being obtained.

Production of alumina. W. BOEHM. Ger. 369,826, *Oil & Color Trade Jour.*, **66**, 1051(1924).—An elec. current is passed through a mixt. of clay with alkali lye, or with such alkali compds. as are capable of decompn. of a silicate.

A rapid method for the determination of true (or powder) specific gravity. W. HUGILL AND W. J. REES. *Jour. Soc. Chem. Ind.*, **43**, 986(1924).—(Meeting of English Ceramic Society, Sept. 18 and 19.) The app. used consists of a conical flask with a long neck, at the lower end of which is a wide bulb. At the bottom of the neck is the 250 cc. mark, and above the bulb the neck is graduated in sp. gr. from 2.00 to 2.70 so that the sp. gr. may be read off directly. Xylene is poured into the flask up to 250 cc. and exactly 100 g. of dry powder is then dropped gradually into the flask. After standing 2 mins. to let air bubbles rise, the sp. gr. is read off. Crushing the dry brick to pass a 30-mesh sieve yields results accurate within 0.01%. H. H. S.

Sedimentation of bentonite. H. F. COWARD. *Jour. Chem. Soc.*, **125**, 1470–4 (1924); *Jour. Soc. Chem. Ind.*, **43B**, 786(1924).—Bentonite readily forms milky suspensions by shaking with water after soaking for a few minutes. The suspensoid is negatively charged, and is reversibly coagulated by suitable addns. of electrolytes. The easy prepn. of these suspensions suggests their possible use as a mat. for colloid investigations. H. H. S.

Emilium. LOISEL. *Jour. Soc. Chem. Ind.*, **43**, 986(1924).—(Meeting of French Academy des Science, Sept. 15.) A new radio-active body to which is given the name emilium yields an emanation in the gas given off by thermal springs at Bagnoles de l'Orne, and in the granite rocks from which issue the springs. H. H. S.

Determination of magnesium in aluminum, zinc and lead alloys. B. FETKENHEUER AND A. KONARSKY. *Wiss. Veröff. Siemens-Konz*, **3**, 19–21(1924); *Jour. Soc. Chem. Ind.*, **43B**, 791(1924).—The non-ammoniacal soln. is poured into KOH. $Mg(OH)_2$ is pptd., filtered, dissolved and after treatment with NH_4Cl, NH_4OH, NH_4HS, pptd. as phosphate. H. H. S.

Thermal conductivity and compressibility of several rocks under high pressure. P. W. BRIDGMAN. *Am. J. Sci.*, **7**, 81–102(1924).—Summary: The thermal condy. of pipestone, talc, Solenhofen limestone, basalt, Pyrex glass and rock salt has been measured up to 12,000 kg./cm.^{2} at 30° and in most cases at 75° also. The condy. increases with rising pressure by an amt. which may vary from 0.1% per 1000 kg. at 30° for Solenhofen limestone to 3.6% for rock salt. Probably for the ordinary rock of the earth's crust the effect is not over 0.5% at ordinary temps. The abs. condy. and its pressure coeff. may either increase or decrease with rising temp. A simple hydrostatic pressure applied to substances of the character of those measured does not in general produce a uniform change of vol., but the effects are complicated. The relation between pressure and deformation may be affected by hysteresis in a direction the reverse of normal. This occurs in pipestone, Solenhofen limestone, and basalt in amts. varying from a few per cent to 18% of the whole deformation. Talc and pipestone show large differences of linear compressibility in different directions; this effect was not investigated for the other materials. Pyrex glass has an abnormal increase of compressibility at high pressures. The geol. consequences of the foregoing results are discussed.

L. W. R. (*C. A.*)

Decomposition of pyrite by heat. MLLE. G. MARCHAL. *Bull. soc. chim.*, **35**, 43–7(1924).—Very pure pyrite, finely ground, was heated both *in vacuo* and in a current of N. *In vacuo* decompn. became evident at 500°. The loss of wt. was 1.22% per hr. at this temp. and increased to 2.03% per hr. at 550°. At 670–80° decompn. into S and FeS was complete in 8 hrs. The S deposits on the tube walls in cryst. form and high purity. The decompn. is rapid at 850°. At 1000° or higher the sulphide product corresponded closely to $FeS_{0.9}$. Heating in a current of N at 850° for 1 hr. gave complete decompn. into FeS and pure cryst. S. A. R. M. (*C. A.*)

Study of clays. V. The action of heat. O. BOUDOUARD AND J. LEFRANC. *Bull. soc. chim.*, **33**, 1627–40(1923); cf. *C. A.*, **17**, 3009.—The ignition loss of 7 clays and 2

halloysites, heated to various temps. from 182° to 1000°, was studied. The hygroscopic H_2O was evolved continuously and slowly up to 450°. The liberation of combined H_2O started at 450° and was complete at 500°. Some anomalies were noted. The halloysites showed, at about 800°, a further definite loss of H_2O. One of the clays in particular showed a similar loss of H_2O at 800°. C. H. K. (*C. A.*)

The estimation of chromium in nickel-chrome alloys. "METT." *Chem. Age* (London), **9,** 364(1923).—Heat 0.2–1 g. of alloy in a Ni crucible with 10 g. Na_2O_2. Ext. the Na_2CrO_4 with water, make acid with HNO_3, neutralize with NH_4OH and then acid with AcOH. Ppt. $PbCrO_4$, filter, dissolve in 2 *N* H_2SO_4 and det. Cr volumetrically with $FeSO_4$ soln. and $KMnO_4$ in the usual way. W. T. H. (*C. A.*)

Behaviour of gases in contact with glass surfaces. D. H. BANGHAM AND F. P. BURT. *Roy. Soc. Proc.*, **105A,** 481–8(1924).—The sorption of carbon dioxide by fine glass wool has been found to be very accurately represented by the equation, $s^m = kt$, where s is the amt. sorbed under a certain press. during the time, t, and the index, m, increases with the pressure. An equation showing desorption has also been deduced. Further, the quantities of sorbed gas in approx. equilibrium with a given pressure, have been found to be expressed by the Freundlich equation, $s^n = k'p$, where n is a constant charac. of the gas, being apparently larger the greater the soly. of the gas in water. M. S. B. (*J. S. C. I.*)

Calcium sulphate solutions. P. JOLIBOIS AND L. CHASSEVENT. *Compt. rend.*, **178,** 1543–6(1924).—The soly. curve of $CaSO_4$, $^1/_2H_2O$ is traced in its metastable region and the rate of crystn. of the dihydrate from supersatd. soln. plotted. Seeding the soln. with the dihydrate starts immediate crystn., but the addn. of anhydrous calcium sulphate (calcined at 200–1000°) has no effect. The explanation of the setting of plaster of Paris, calcined at high temp., must, therefore, not be sought in the starting of crystn. but rather that transformation into the hemihydrate in contact with the soln. is slower the higher the temp. of calcination in consequence of a diminution in the active surface. J. W. B. (*J. S. C. I.*)

PATENTS

Process for producing and utilizing alkalies and alumina. ALFRED H. COWLES. U. S. 1,508,777, Sept. 16, 1924. A process of treating leucite, feldspar and like alkali-alumina-silicates, which consists in subjecting them to a sintering process with such proportions of sodium metal carbonate and an alkali earth metal carbonate as will give a sintered product containing one molecular weight of silica to two molecular weights of alkali earth oxide and less than one and seventy-six hundredths molecular weights of alkali metal oxide to one of alumina, and leaching the sintered product.

Process for the production of alumina and nitrates. HANS JOACHIM FALCK AND THOR MEJDELL. U. S. 1,507,993, Sept. 9, 1924. Process for the production of alumina and nitrates which consists in forming a mixt. of nitrates containing aluminum nitrate, mixing such mixt. of nitrates with an alumina-contg. mat. in such a quantity that the resulting mixt. will not melt during the subsequent htg., htg. said resulting mixt. in the presence of a basic subs. and working the product of the htg. opern. for the recovery of alumina and nitrates.

Process of producing aluminum chloride and sodium silicate. SAMUEL PEACOCK. U. S. 1,507,709, Sept. 9, 1924. The process of producing aluminum chloride, and sodium silicate, from naturally occurring aluminum silicates, which consists in calcining said silicates and mixing the same with sodium chloride; subjecting the mixture thus produced to a reacting temp. to produce the desired aluminum chloride and sodium silicate; passing free nitrogen over the charge to sweep out the volatile aluminum chloride and recovering said sodium silicate from the fur., substantially as described.

Fire-resisting paint. NEVIL MONROE HOPKINS. U. S. 1,507,181, Sept. 2, 1924.

The herein described new paint compn. consisting of a water soln. of sodium silicate in the proportions of $1^1/_2$ pints; sodium fluoride $^1/_2$ pint; 6 oz. finely divided asbestos and 6 oz. asbestine admixed with sufficient kaolin, and zinc oxide to increase the hiding power of the paint and sufficient coloring matter to provide a predetd. color thereto.

General

Pottery Expansion in United States breaks record in 1923. ANON. *The Ceramist,* 278(1923–4).—42 glost and biscuit kilns for general ware, and 6 double decorating kilns were built in the 12 months' period prior to December 4, 1923. This is a greater increase than any single year in the history of the industry. Notes relating to charges and improvements in individual plants. C. W. P.

Safety work in the pottery industry. The New Jersey State Industrial Safety Museum. LEROY W. ALLISON. *The Ceramist,* 249(1923–4).—A description of the purpose and equipment of the N. J. State Industrial Safety Museum with special reference to its exhibits and devices recommended for the ceramic industry. C. W. P.

Mineral industry of the British Empire and foreign countries. *Imp. Min. Resources Bur.*(1924).—Statistical Summary: Production, imports and exports, 1920–22. O. P. R. O.

Swedish testing laboratory. *Indus. Australian and Mining Stand.,* **72,** 249.—The Swedish Testing Laboratory at Stockholm announces that it is open to exporters from other countries desirous of having samples of any mat. tested when in doubt as to whether they comply with Swedish import regulations. The Testing Institute is managed by a board of directors and has skilled experts on its staff. O. P. R. O.

Standardization of scientific glassware. *Nature,* **114,** 485(1924).—Units of volume, the first rept. issued by the Joint Comm. for the Standardization of Sci. Glassware records unanimous recommendation to discard the cc. as the standard unit for scien. glassware and to institute therefor the liter and the milliliter. As some chemists prefer the Mohr unit, the Comm. adds 2 further recommendations, to obviate confusion between the 2 systems, although it hopes that in time the liter and the milliliter will be adopted exclusively. It recommends that vessels graduated on the Mohr system should be marked "g. w. a." (grams of water in air) and the numerical relation between the units shall be 1000 g. w. a. = 1002 ml. Whereas the vol. of a body of simple geometrical form is readily calcd. from its linear dimensions, the vol. of a hollow vessel designed to hold a fluid is detd. more easily and more accurately by finding the wt. of water required to fill it. This has many disadvantages, especially if there is no simple numerical relation between them. To establish such a relation, the originators of the metric system defined the kg. as the mass of water which occupies one cu. decimeter at its temp. of max. d.; so that the unit of vol., the liter, could be defined either as a cu. decimeter or as the space occupied by a kg. of water at the specified temp. A cu. decimeter of water was not a practical standard wt., and the kg. was therefore redefined as the mass of a particular standard wt. (*kilogram des Archives*). In accordance with this change, the liter was redefined as the vol. occupied by one kg. of pure water at its temp. of max. d. and under normal atmospheric press. Thus the liter became independent of the metric unit of length, and the cu. centimeter lost its relation to the vol. of a mass of water. The relation between the liter and the cc. was found experimentally to be 1 liter = 1000.027 cc. ($\pm$0.001), a difference so small as to be negligible for ordinary glassware. The introduction of the Mohr system caused confusion, inasmuch as by it the unit vol. was defined in terms of the apparent wt. in air of a mass of water at room temp. By this system a liter flask contains 1000 gm. of water (weighed in air against brass wt.) at 17.5°C, which is the equivalent of 1002 cc. as defined above.;

but the followers of Mohr designated the vol. occupied by 1000 gm. of water one liter, and $^1/_{1000}$ part of it one cc. The exact relation between the Mohr unit and the milliliter is given by the fact that the amount of water which weighs 1000 gm. in air of density 0.0012 gm./ml., when weighed against brass wts. of density 8.4 gm./ml., occupies a vol. of 1002.021 ml. at 60°F. The difference between this fig. and 1002, namely, 2 pts. in 100,000, is negligible in practice, and hence the Comm. recommends the adoption of the round number, thus facilitating inter-conversion of "g. w. a," and milliliters. The Comm. has also considered the accuracy of volumetric glassware, and recommends adoption of only two grades: Class A, or standard app., and Class B, or commercial grade app. The Class A Tests and the Class B Tests of the Nat. Phys. Lab. are approved. The Comm. urges that volumetric glassware should never be ordered without specifying the limits of accuracy required. O. P. R. O.

Heat losses from steam-line pipes. R. H. Heilman. *Blast Fur. Steel Plant*, **10**, 261–5(1922).—Data are given on bare pipes operating at temps. up to 427 together with curves and formulas, enabling ready solution of problems encountered in the calcn. of heat losses from bare and covered pipes. The general formula giving good results is $T_d = 272.5h/[h + 564/D^{0.10}]$. T_d = temp. difference between canvas surface and room (°F); h = total B. t. u. loss per hr. per sq. ft. of canvas; and D = outer surface diam. (inches). An example is given. W. H. B. (*C. A.*)

High-temperature electric furnace. Anon. *Chem. Met. Eng.*, **29**, 1149(1923); 1 illus.—A furnace was designed with solid graphite resistors. A special low-voltage transformer of large capacity is used. A high power input makes the necessary high temp. easily attainable, after which the power input is reduced to the working rate. The graphite resistors have a rather short life, which may be increased slightly by the injection of a small amt. of illuminating gas into the high-temp. chamber.

W. H. B. (*C. A.*)

BOOKS

Reference List of Bibliographies: Chemistry, Chemical Technology and Chemical Engineering Published since 1900. Compiled by Julian A. Sohon and W. L. Schaaf. New York: H. W. Wilson Co. 100 pp. $1.50. Reviewed in *Ind. Eng. Chem.*, **16**, 543 (1924). (*C. A.*)

Hainbach, Rudolph: **Pottery Decorating.** New York: D. Van Nostrand Co. 2nd ed., revised. 256 pp. $3.00. (*C. A.*)

Our Annual Meeting

February 16-21

Columbus, Ohio

That it will be the best ever is already assured.

More papers than ever are scheduled.

More persons have definitely planned to attend.

More exhibitors of equipment and material have reservations.

A fine plant itinerary for each division is planned.

The college boys and girls will entertain.

And this is the occasion for celebrating the 30th Anniversary of the founding of the world's first department of Ceramic Engineering—an event of international importance.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical and Scientific Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

F. H. Rhead, H. S. Kirk — Art
H. F. Staley, R. R. Danielson — Enamel
A. R. Payne, A. E. Williams — Glass
E. E. Ayars, R. F. Ferguson — Refractories
F. H. Riddle, C. C. Treischel — White Wares
A. F. Hottinger, R. L. Clare — Terra Cotta
R. B. Keplinger, A. P. Potts — Heavy Clay Products

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Vol. 3 — January, 1924 — No. 1

EDITORIALS

WHAT OF 1924?

The twenty-fifth year of service is now history. The mistakes and shortcomings cannot be retrieved. The things accomplished will continue always as benefits to ceramic industries. There is only one sane resolution of purpose for the new year; each officer, committeeman and member will do his share in achieving more in 1924 than has been achieved in any previous year.

The 1923 conventions of the Society were the most largely attended and of the greatest value. Those of 1924 will exceed those of 1923. The Committees accomplished more in 1923 than in any previous year and they are set for even greater productiveness in 1924. The 1923 *Journal* of original research reports was more voluminous and equal in quality to any previously published and the *Journal* for 1924 promises to be equal to if not surpassing that of 1923.

The abstracts of the world's ceramic literature was progressed in 1923 in quality and scope but the plans for 1924 have been perfected in detail for even more thorough and better abstracting.

The Society will accomplish in 1924 just what the members shall will it to accomplish. There is no one person nor any group of persons elected or self-appointed who can have an enduring reason or a continued opportunity to make of the Society anything other than what is profitable to the

majority of the members. The prospects for 1924 are indeed very promising in increased value of services rendered by the SOCIETY.

THE BIG IDEA OF THE AMERICAN CERAMIC SOCIETY

1. The AMERICAN CERAMIC SOCIETY was founded twenty-six years ago by a group of ceramic manufacturers and educators to promote the ceramic arts and sciences. It was chartered under the laws of Ohio as a non-profit sharing corporation for this announced purpose and has continued as such for these twenty-six years.

2. Six years ago it reorganized its procedure by establishing Industrial Divisions and Local Sections, and changing its publication from annual *Transactions* to a monthly *Journal*, and establishing standing committees for Research, Standards, Data, Geological Surveys and Education.

3. The Divisions and Local Sections are self-governing groups each with their own officers and committees. Each Division holds four technical sessions at the Annual Convention thus making these conventions really seven conventions in one.

4. The method of promoting the ceramic arts and science is by (*a*) conventions, (*b*) publications of research reports, (*c*) abstracting of the world's literature, (*d*) preparation of bibliographies, (*e*) assisting research laboratories in the finding of problems, the securing of materials and analyzing the results and (*f*) promoting coöperative research and ceramic educational enterprises.

5. The SOCIETY promotes the making of research contacts by trade associations with established laboratories, and develops collaborations of private industrial laboratories.

6. It organizes research groups of manufacturing concerns for the benefit of the supporting firm members.

7. It carried through the campaigns that resulted in the establishing of ceramic departments in the Federal Bureaus and has promoted the establishing of collegiate ceramic schools.

8. These several activities may be summarized into the one "Big Idea of the Society," that of a strong promoting, reporting and recording research and educational organization of ceramic manufacturers in which all have a common interest and equal rights and benefits.

9. It does not encroach upon nor conflict in purpose with any activity which any trade association or publication has or could undertake. In fact, the constant endeavor is to collaborate with these trade organizations. It does not finance researches, maintain laboratories nor conduct courses of ceramic education. It does not maintain its *Journal* for financial profit.

10. It is said, and we believe truly so, that the conventions and publications of the American Ceramic Society have been more productive and most effective agents for the dissemination of knowledge of ceramic technology and science. The Society has been constant in its advocacy of research and technical plant control until today there is a very general appreciation of the value of these as shown by the coöperative researches conducted by trade associations and by the demand in excess of the supply for trained ceramic engineers.

11. We submit that there is an economic value in all industrial ceramic groups supporting this Society both on account of the many problems that are of common concern and because of the importance of maintaining the strongest possible research promoting and publishing organization devoted altogether to the promotion of the ceramic arts and sciences. The American Ceramic Society is not commercial either in purpose or procedure. All of its income is spent in service. It is not controlled by any limited interest but is managed by a board of eleven, nominated and elected by its supporting members. Everything possible must be done to meet the expectations of the 1962 persons and 290 corporations who are now supporting the Society. It is for this reason we are seeking the confidence, support and collaboration of all ceramic persons, concerns and associations.

If you believe that a strong organization of this sort and for the purposes stated is of value you are urged to participate in the work and to invite others to share in its support and in the benefits which accrue.

ACTIVITIES OF THE SOCIETY

THE PRESIDENT'S PAGE

Our Membership Growth

By A. F. Greaves-Walker

There has been no doubting of the value of having one strong and active association such as is the American Ceramic Society, common to all ceramic interests for the exclusive purpose of promoting the technical, scientific and artistic welfare of the ceramic industries.

There has been no questioning of the honor, rights and benefits of membership in such an organization governed as this Society is for, by and of the members.

There has, however, been a questioning of the value of broadcasting the privileges of membership to all ceramic workers. It would be futile to argue the case for it is a demonstrated fact that the more generally peoples are informed the higher will be the plane of excellency in production and the greater will be the returns to all, both materially and in personal comfort and satisfaction. This is true in social and political life. The country in which the opportunities for education and the means of pleasure and comfort are the most generally enjoyed is the most progressive and is the most substantial. This is true in all human activities. It is true in ceramics.

It is sound in practice and in theory for each ceramic group to maintain separate trade organizations. Each has its own peculiar labor and trade problems.

It is practical and certainly most effective in promotion of the technical welfare of each group and of ceramics in general that each trade association engage in coöperative research of their production problems. There is value accruing directly to each trade association group and indirectly to ceramic industries generally in operative institutes and vocational schools. It has been demonstrated that the industries can in these ways do more to produce better ware at lower cost and be more able to keep abreast with competition and quality demands.

The direct returns from technical research and education is an experienced reality. It does not admit of argument and there is no need of demonstration. There is, however, the necessity of bringing each manufacturer to an actuating appreciation of the returns which surely will follow from technical research and education.

We often forget that there would be no amount of technical advance made and very little education had if there were no revealing record made of observations and experiences so that the ideas and findings of each can be tried by several under different conditions and for different purposes until the fundamental principles have been found and demonstrated. The Universities cannot create all the knowledge. They can merely do their bit along with others as a side line to their principal business of training men educationally. It is from records of industrial application that most knowledge is obtained.

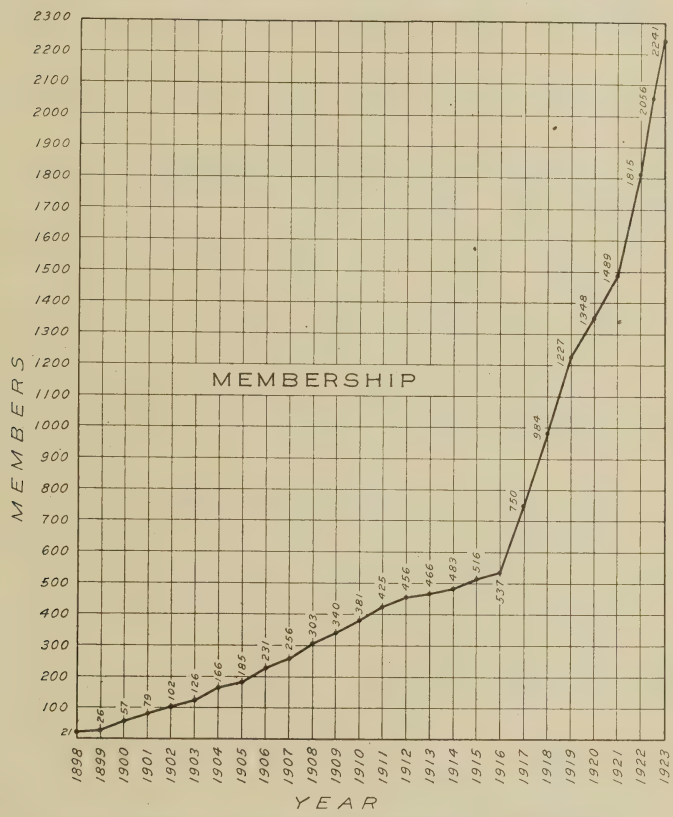
It should be very apparent that it is important to progress of industrial ceramics that there be a common pooling agency for all the ceramic groups such as the American Ceramic Society through and by which knowledge is recorded, abstracted and indexed; and by and through which the several groups contribute their share to the general record of facts and principles. There is an inestimable value to each ceramic concern to have the world's literature abstracted and made available. There is a direct value in committees gathering proved data and finding means of contact with and giving assistance to research agencies in the finding of new facts of immediate importance.

With so much in common technically, there is direct value in all the ceramic groups giving adequate support to a common agency devoted exclusively to the promotional

activities. And it is equally important that the educational benefits of participation in the obtaining and recording of ceramic knowledge shall be extended to every employee and employer who has the capacity and the desire to use knowledge.

The ceramic fraternity generally takes pride and has reason for satisfaction in the growing appreciation of the value of technical research and education and of the need of having a strong organization through which the knowledge from world-wide sources are collected and made known. This growing appreciation is shown by the rapidly growing roster of the American Ceramic Society.

ARE WE GOING OVER THE TOP?



New Members Received from Nov. 16–Dec. 15

Personal

Robert Burhans, Jr., 607 Pacific Finance Bldg., Los Angeles, Calif., President and Genl. Mgr., Feather-Stone Insulation Co.

Robert R. Busbey, Canton, Ohio, Sales Engineer, The Robinson Clay Product Co., Akron, Ohio.

A. J. Des Lauriers, 311 Chestnut St., St. Paul, Minn., Manufacturer of Milk Cans.

Edwin Burk Estabrook, 4901 Stenton Ave., Philadelphia, Pa., Sales Engineer, Leeds & Northrup Co., Philadelphia, Pa.

Harold Feichter, 209 W. 8th St., Parkersburg, W. Va., with U. S. Roofing Tile Co., Parkersburg, W. Va.

C. Walther Fernholtz, 2053 E. 38th St., Los Angeles, Calif.

Thomas Graham, Box 938, Medicine Hat, Alberta, Canada, Supt., Alberta Clay Products Co., Ltd.

Joseph C. Hearn, President, Saks Stamping Co., Huntington, W. Va.

W. G. Jackson, 258 South Alexandria Ave., Los Angeles, Calif., Manager, Empire China Co., Burbank, Calif.

William G. Jackson, Jr., 258 South Alexandria Ave., Los Angeles, Calif., Empire China Co., Burbank, Calif.

Richard D. Leitch, Asst. Chem. Engr., U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.

James H. McCabe, 1758 Central Ave., Cincinnati, O., McCabe Construction Co.

Clarence B. McComas, 1226 Belmont Ave., Baltimore, Md., Chemist, Carr-Lowrey Glass Co.

Wm. E. Magill, Buckwater Stove Co., Royersford, Pa., Mgr., Enamel Dept.

Carl Mehling, 2248 Elmwood Ave., Buffalo, N. Y., Manager, Enamel Department, American Radiator Co.

James G. Moore, 701 Vernon Ave., Long Island City, N. Y., Manager, Peerless Glass Co.

Douglas E. Parsons, 1824 New Hampshire Ave., Washington, D. C., Associate Engineer, Ceramic Division, U. S. Bureau of Standards.

William Pettigrew, 728 Main St., Worcester, Mass., Assistant, Microscopical Division, Research Laboratory, Norton Co., Worcester, Mass.

Frank Piatt, 1495 Franklin Ave., Apt. C, Columbus, Ohio, Salesman, Louisville Fire Brick Works, Louisville, Ky.

Fred Redmond, Pacific Clay Products, Inc., Los Angeles, Calif.

Wm. A. Roffe, Pacific Beach, San Diego, Calif., Secy. and Treas., San Diego Tile & Brick Co.

Olive F. Shults, Alfred, N. Y., Student at State School of Ceramics.

M. A. Snell, 220 Wisconsin Ave., Oak Park, Ill., Chemical Engineer, Ceramics Division, Western Electric Co., Chicago, Ill.

Norman Stein, Bonnybridge, Scotland, Director, John G. Stein & Co., Ltd.

Chas. H. Taylor, McCall, Ky., Mfr. of fire brick and refractories.

Herbert K. Turk, Porcelain Enamel & Mfg. Co., Baltimore, Md.

G. B. Tuthill, 131 West 63 St., Chicago, Ill.

John H. Voorhies, Alfred, N. Y., Student at State School of Ceramics.

Henry Weiss, West Coast Porcelain Mfrs., Millbrae, Calif.

Corporation

The Baltimore Enamel & Novelty Co., P. O. Box No. E-4, Baltimore, Md., Porcelain Enamel Signs, H. B. Little, Vice-president.

The Crossley Machine Co., Trenton, N. J., Machinery Manufacturers, Donald M. Miller, Sec'y.

Locke Insulator Corp., Maryland Trust Bldg., Baltimore, Md., Porcelain Insulators, F. H. Reagan.

Montgomery Porcelain Products Co., Franklin, Ohio, Mfrs. of Pyrometer Protection Tubes, E. T. Montgomery, Member of Firm and General Manager.

Southern California Gas Co., 950 South Broadway, Los Angeles, Calif., Lee Holtz.

The Robinson Clay Product Co., 1100 Second National Bldg., Akron, Ohio. Manufacturers of Sewer Pipe and Fire Brick, H. B. Manton, Pres.

Membership Workers' Record

	Personal	Corporation		Personal	Corporation
C. E. Bales	2		E. T. Montgomery		1
A. W. Crownover	1		F. B. Ortman	1	
R. R. Danielson	1		W. G. Owen	1	
Howells Frechette	1		William E. Rice	1	
C. E. Fulton	1		John Sawyer	4	
R. F. Geller	1		Alan Stein	1	
Arthur F. Gorton	1		Homer F. Staley		1
R. K. Hursh	1		Karl Turk	2	
A. A. Klein	1		Edward J. Vachuska	2	
T. G. McDougal		1	Office	7	2
C. R. Minton		1		—	—
			Total	29	6

PERSONAL NOTES OF MEMBERS

E. E. Ayars, Chairman of the Refractories Division, is living at 11020 Detroit Ave., Cleveland, Ohio.

Wilbur F. Brown, formerly of New York has been transferred by the Libbey-Owens Glass Company to Nicholas Bldg., Toledo, Ohio.

J. L. Crawford, who has been Research Assistant, Mellon Institute, Pittsburgh, Pa., has accepted a position with the Laclede-Christy Clay Products Co., Railway Exchange Bldg., St. Louis, Mo.

J. C. DeKort is living at 951 Main St., Wheeling, W. Va.

W. E. Dornbach has moved from Baltimore, Md. to 929 Marlyn Road, Philadelphia, Pa.

William H. Lucktenberg has notified the Secretary's office that he has moved from Zanesville, Ohio to 445 S. Ohio Ave., Columbus, Ohio.

George J. Openhym asks that his address be changed from Scarsdale, N. Y. to 80 Walworth Ave., White Plains, N. Y.

F. A. H. Schepers of the Advance Terra Cotta Company has moved from Chicago Heights to Crystal Lake, Ill.

V. S. Schory has moved from 231 Hudson St., Tiffin, Ohio to 914 W. Walnut St., Kokomo, Ind.

Frank C. Schultz, student member has moved to 231 16th Ave., Columbus, Ohio.

Arthur R. Stanbra has notified the Secretary's office that he has moved to 951 Main St., Wheeling, W. Va.

W. J. Sutton, who has been Assistant in the University of Pittsburgh has moved to Foochow, Fukien Province, China., Fukien Christian University.

George A. Williams of Tottenville, Staten Island, N. Y., has accepted a position with Wunderlich Ltd., Sydney, Australia.

Warren S. Williams, formerly of Arnold, Pa., is now living at 815 E. Harvard St., Glendale, Calif.

Wm. A. Yung of the MacBeth-Evans Glass Company has been transferred from Pittsburgh to the Charleroi office of the Company.

NEW LOCAL SECTIONS ORGANIZED

University of Washington Student Local Section

The Board of Trustees of the American Ceramic Society has granted a petition for the formation of a Local Section of the Society to be known as the University of Washington Student Section of the American Ceramic Society. The officers elected are M. E. Reynolds, Chairman and Wallace Thoreson, Secretary. Paul S. MacMichael and Hewitt Wilson were instrumental in the organization of the Section. Monthly meetings will be held throughout the year. Those signing the petition for a Charter were Winthrop C. Brown, Hobert R. Goodrich, Hilding E. Johnson, M. E. Reynolds, Wallace Thoreson, Fred W. Schroeder, Henry C. Fisher, Thomas J. Etherington, Thad. O. Smith, Ralph L. Smith.

Pacific Northwest Section

A second petition has been received by the Board of Trustees of the Society asking that a charter be granted to a new Section, to be known as the Pacific Northwest Section of the American Ceramic Society. The organization was effected at a meeting of the Pacific Northwest Clayworkers' Association held on December 8. The Section was formed to take care of all matters dealing with relations between the American Ceramic Society and the Pacific Northwest Clayworkers' Association.

The officers chosen for the Section are Paul S. MacMichael, President, and Hewitt Wilson, Secretary. S. Geijsbeek was elected Councilor until the January meeting. An invitation has been extended to the members of the Society to visit the Pacific Northwest on the Summer Meeting tour for 1924.

The following members signed the petition asking for the charter: Paul S. Mac Michael, S. Geijsbeek, H. Wilson, F. T. Houlahan, R. A. Swain, M. L. Bryan, Charles P. Oudin, Ernest F. Goodner, W. E. Lemley, A. Lee Bennett, A. H. Wethey, Jr., and L. A. Martin.

Baltimore-Washington Section Petitions

On December 14, 1923, the organization of the Baltimore-Washington Section of the American Ceramic Society was held at the Garden Tea House, Washington, D. C. Thirty-eight were present and the following officers were elected.

B. T. Sweely, Chairman
Karl Turk, Councilor
R. R. Danielson, Vice-chairman
Secretary-Treasurer, Herbert Insley

A motion was passed that the American Ceramic Society be petitioned for permission to form a local section and that dues of $1 a year would be asked to carry on the work of the Section. Members will also be admitted who are not members of the American Ceramic Society.

The meeting was concluded by a short paper by Herbert Insley on the uses of the petrographic microscope in the ceramic industry.

Those attending the meeting were:

Stephen Leech, B. T. Sweely, Joseph P. Rodgers, Karl Turk, Hebert Turk, Richard Turk, Albert Krekel, Edgar A. Worsham, B. W. Ellis, C. B. McComas, C. A. Barrett, Reardon Fusselbaugh, H. B. Little, R. M. Balmert, A. C. Cameron, F. W. Owens, W. B. Taylor, R. R. Danielson, H. D. Foster, Karl Langenbeck, W. L. Prendergast, M. L. Walters, T. D. Hartshorn, A. N. Finn, W. N. Harrison, H. L. Gaardsmoe, V. J.

Roehm, P. H. Bates, D. C. Lindsay, D. E. Parsons, R. F. Geller, E. W. Washburn, Louis Navias, H. G. Wolfram, W. J. Scott, H. Insley.

Fall Meeting of the Pittsburgh Section

H. G. Schurecht

A dinner was served at the University Cafeteria and in spite of the bad weather about forty attended. After the dinner, and before going over to Mellon Institute, R. C. Purdy gave a short informal talk on the growth and development of the Society. Following this the regular meeting was held at the Mellon Institute. The meeting was called to order by Professor A. Silverman.

Professor Silverman proceeded to introduce Frederick Carder of the Steuben Factory, Corning Glass Works, an authority on colored and art glass. Mr. Carder gave an interesting illustrated talk on the development and technique of the glass industry starting with ancient practice and leading up to that of modern times. He concluded his talk by exhibiting some beautiful specimens of modern art glass.

The next speaker introduced by the chairman was Jameson Handy of the Picture Service Corporation of Chicago. His talk was on the value and application of animated and "slow moving pictures" to modern science and how the camera can detect and show things that the eye cannot perceive. He illustrated this by showing a series of three reels of pictures ending with an animated cartoon picture.

A rising vote of thanks was then extended to Mr. Carder and Mr. Handy, and the meeting adjourned.

Those attending:[1]

C. G. Dunkle,—H. J. Heinz Co.
Chas. R. Fettke,—Carnegie Tech.
C. J. Huot,—Pittsburgh Lamp Brass & Glass Co., Swissvale, Pa.
F. C. Flint,—Hazel-Atlas Glass Co.
W. F. Wenning,—Vitro Mfg. Co.
C. R. Peregrine,—% Macbeth Evans Glass Co.
Donald W. Ross,—Findlay Clay Pot Co., Wash., Pa.
Theo. Lenchner,—Vitro Mfg. Co.
John F. Laudig,—H. J. Heinz Co.
K. T. Cheong.
Rudyard Porter.
A. Silverman,—Univ. of Pittsburgh.
H. W. Webber,—Vitro Mfg Co.
Dr. E. W. Tillotson,—Mellon Institute.
T. W. Garve,—Findlay Clay Pot Co., Wash., Pa.
Dr. C. J. Engelder,—Univ. of Pittsburgh.
W. A. Carter,—Burrell Technical Supply Co.
M. L. Bell,—Carnegie Steel Co.
F. Robertson,—Mellon Institute.
C. E. Skinner,—Westinghouse Electric Co., East Pittsburgh.
G. Pole,—Mellon Institute.
K. F. Stahl.
F. F. Rupert,—Mellon Institute.
T. J. Volkommer,—Vitro. Mfg. Co.
R. W. Henry,—Mellon Institute.
L. H. Miller,—Carnegie Institute.

[1] Members are from Pittsburgh unless specified otherwise.

W. C. Fernow,—Aluminum Company of America.
Wm. A. Yung,—Macbeth-Evans Glass Co.
O. P. Brysch,—Koppers Co. Labs., Mellon Institute.
Harold J. Rose,—Koppers Co. Labs., Mellon Institute.
O. O. Malleis,—Koppers Co. Labs., Mellon Institute.
Roy E. Swain.
A. C. Bakken,—Aluminum Company of America.
W. N. Stoneman.
C. S. Taylor,—Research Bureau, Aluminum Company of America.
C. A. Styer,—Westinghouse Electric Co., East Pittsburgh, Pa.
C. M. Bouton,—Bureau of Mines.
H. H. Blau,—Macbeth-Evans Glass Co.
K. K. Stevens,—Carnegie Tech.
D. O. Evans.
S. S. Cole, Koppers Co. Labs., Mellon Institute.
F. Merian.
C. A. Stone,—Macbeth-Evans Glass Co.
C. H. West,—Westmoreland Specialty Co., Grapeville, Pa.
S. B. West, Westmoreland Specialty Co., Grapeville, Pa.
A. E. Blake,—The U. G. I. Contracting Co.
R. C. Purdy,—General Secretary, American Ceramic Society, Columbus, Ohio.
J. E. Hansen,—Mellon Institute.
R. E. Arnold.
T. H. Sant,—John Sant & Sons Co., East Liverpool, Ohio.
C. J. Rodman,—Westinghouse Electric Co, East Pittsburgh, Pa.

1924 ANNUAL CONVENTION

Atlantic City in February is delightful. None of the hotels would consider a convention between February 15 and April 1, because of the regular patrons who during this period crowd Atlantic City. It was necessary to set the convention ahead to the week of February 4 to get it scheduled in Atlantic City. The weather is fine, the salt water bathing is fine, and the board walk and piers are going full tilt all during February.

So much for the season.

The place needs no advertising; it is the greatest resort in America, winter or summer. So much for the place.

Those who attended the last two annual conventions of the American Ceramic Society know that there will be people there to meet, papers to hear, discussions to participate in, and buttonhole lobby chats which none can afford to miss. The general sessions on Monday will be of great interest and value to all. The Division Sessions on Tuesday and Wednesday will pound brass tacks into your problems. Each industrial group will meet separately, with the programs for each confined to their specific and special problems.

The occasion, by record established and by program assured, will be most profitable.

The hosts—can there be a more promising forecast of a well organized, comfortable stay in Atlantic City than to say that the New Jersey Clay Workers Association and Eastern Section of the American Ceramic Society will be the hosts?

This is the set-up for a dignified and profitable convention in America's greatest playground at a popular time of the year for a sea-shore vacation.

SOME OF THE 1923 WORKERS[1]

In the good old days when the entire membership could sit around a table in Section Q with open notebooks and with open frank minds and when each one was known and hailed by his first name, there was a fellowship, a "bond that ties" which counted for loyalty to the group and to each other.

Today there are several such group meetings together and the development and showing of that same fellowship and loyalty which distinguished that single group twenty to twenty-six years ago. There is today more extensive and intensive fellowship among ceramists. This does not need cultivating; it is flourishing because of its realized value to the individuals, to the SOCIETY and to industrial ceramics in general.

It is impossible, however, for any person, even the General Secretary, to know all the members. There is need of making more generally known the faces and the history of the individuals. A complete album, as is had by many organizations, would be very valuable and the SOCIETY will some day be in position to compile and publish one. It is an anticipation of this that the workers will from time to time be shown in the *Journal.*

Robert J. Anderson

R. J. ANDERSON

Born in Cleveland, Ohio, 1892. Attended Case School of Applied Science, 1910–1914, B.S. in metallurgy, 1914. Elected to all honorary, scientific, and scholarship societies in undergraduate school (Theta Tau, Tau Beta Pi, Sigma Xi); post graduate degree Metallurgical Engineer, Case School 1917. Successively instructor in metallurgy, University of Missouri, School of Mines, Rollo, Missouri; metallurgical engineer, American Rolling Mill Co., Middletown, Ohio; research metallurgist with Henry Howe, Columbia University; engineering editor of *The Iron Trade Review,* Cleveland, Ohio; chief metallurgist Cleveland Metal Products Co.; aeronautical engineer, Bureau of Aircraft Production, Detroit; consulting metallurgist; now metallurgical engineer, chief of non-ferrous metals section, U. S. Bureau of Mines, Pittsburgh. Pioneer investigator in U. S. in metallurgy of aluminum. Wide contributor to technical and scientific press on metallurgy. Author, "Metallurgy of Aluminum and Aluminum Alloys," in press 1923–1924. (Henry Carey Baird Co., New York, N. Y.) Became member of this SOCIETY, 1923. Member, A. I. M. M. E. A. S.

[1] The likenesses and personal histories here given do not include all of the 1923 workers. The photo and sketch of several of them have already been given in earlier issues of the *Journal.* Some are not here through inadvertant oversight of the Editors. Others are adverse to having their pictures and sketches given.

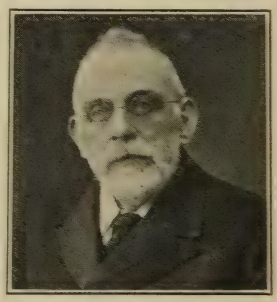
It is not possible at this time to present a complete album of the workers. It is planned to continue collecting photos and personal histories until the SOCIETY shall have its records complete.

T. M.; Institute of Metals (England); Franklin Institute; S. P. E. E.; A. A. A. S.; American Foundrymen's Association; etc. Contribution to *Journal*, 1923, "Metallurgical requirements of refractories."

George H. Ashley

G. H. Ashley

Born 1866, Rochester, New York; graduated 1889 with degree of M.E., Cornell University; 1889–1891, with Ward's Natural History Establishment, Rochester; 1891–1894, assistant, Arkansas Geological Survey; 1892–94, post-graduate student Stanford University, degree of A.M. in 1892, Ph.D. in 1894; 1894–1896, teacher of geology, physics, and chemistry in High Schools of Stockton and San Bernardino, California; 1896–1900, assistant state geologist of Indiana and part time acting state geologist, in charge of survey of coal lands of that state; 1900–1903, professor of biology and geology in College of Charleston, S. C.; at the same time assistant of the U. S. Geological Survey; 1903–1910, assistant geologist and, later, geologist of the U. S. Geological Survey and Chief of Section of Eastern Fuels of all geological work in the eastern coal fields, including coöperative work in Pennsylvania; 1910–1912, state geologist of Tennessee; 1912–1919, geologist, U. S. Geological Survey and part time administrative geologist and acting director. Chief of the Section of Eastern Coal Fields. Chief of the Section on Coal of the Land Classification Board; 1919, state geologist of Pennsylvania. Contribution to *Journal*, 1923, "The fire brick materials of Pennsylvania."



J. A. Audley

James Aloysius Audley

Born 1858, Liverpool, England. Raised in the potteries district of North Staffordshire. Attended evening science classes at the Wedgewood Institute Potteries, Mechanics' Institution, and Minton Memorial Building. Studied as a science teacher in training at the Royal College of Science, 1880–1884. Obtained associateship in geology and biology. Elected fellow of Institute of Chemistry of Great Britain and Ireland and a fellow of the Chemical Society of London. Was graduated 1893 with B.S. degree from London University. Served as Science Master at Hanley for sixteen years, two years organizing and teaching science at Shrewsbury Technical School. Became technical chemist at the Eastwood Sanitary Works, Hanley, 1904–1913. Since 1914 connected with and now director of the New Hall Works Pottery Co., Ltd. Contribution to *Journal*, 1923, "The Ceramic Society (English)."

A. E. Badger

Alfred E. Badger

Born in Cleveland, Ohio, November 25, 1899. Attended Case School of Applied Science 1918–1922.

Associate physicist, glass technology department of National Glass Works in 1922. Joint author with C. D. Spencer of article in *Journal*, 1923, "A skiagraphic study of fabricated glass articles."

Arthur E. Baggs

A. E. Baggs

Born in Alfred, N. Y., 1886. Ceramic training at New York State School of Ceramics, Alfred, N. Y. 1903–1905 and 1909–1911. Appointed instructor in pottery, Marblehead Handcraft Shops, Marblehead, Mass., 1905. Director of Marblehead Potteries since 1905 and owner since 1915. From 1912–1918 had further study in New York City and served as part time instructor at the Ethical Culture School. Became member of the American Ceramic Society, 1910. Member Master Craftsman, Boston Society of Arts and Crafts; New York Society of Craftsmen. Chairman, New England Local Section, this Society, 1923.

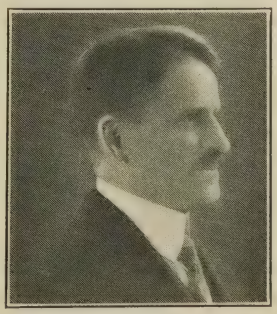
Cecil Eugene Bales

Born in Livingston, Kentucky. Attended public schools in Louisville. Graduated Du Pont Manual Training High School and Branch School of Engineering. College training secured at University of Chicago and University of Kentucky. Chief chemist, Louisville Fire Brick Works and field assistant of Kentucky Geological Survey. Became member of this Society in 1921, active member, 1923. Member American Chemical Society, Ceramic Society (English) and Kentucky Academy of Science. Chairman of Program Committee, Refractories Division this Society, 1923.

C. E. Bales

Frederick E. Bausch

Born in St. Louis, 1871. Graduated from Washington University in 1892 with degree of electrical engineer. Taught three years at St. Louis Manual Training School, 1892–1895. Attended Cornell University, 1895–1896. Electrical engineer with Bell Telephone Co. of Missouri. 1898–1900, mechanical engineer, Missouri Edison Electric Company. 1900–1901, chief engineer, Crystal City, Missouri, plant of Pittsburgh Plate Glass Co. 1901–1923, manager, St. Louis Territory, Hooven, Owens, Rentschler Company of Hamilton, Ohio. Also proprietor of Frederick E. Bausch Fire Clay Mines in St. Louis county and crucible clay mines, Kaolin, Illinois, 1903–1923. Chairman, St. Louis Section, this Society, 1923 Became member this Society, 1919; active member, 1923.



F. E. Bausch

Marcus L. Bell

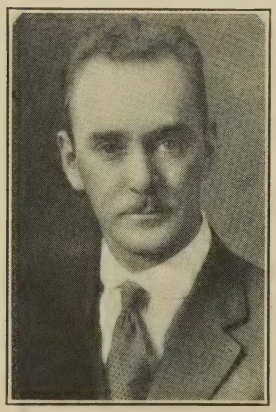
Was graduated from the New York State School of Clay Working and Ceramics at Alfred, New York.

M. L. Bell

Mellon Institute, 1916–1917. Sales engineer, Pittsburgh office, Surface Combustion Company of New York, 1917–1921. Pittsburgh Representative, the U. G. I. Contracting Company, Philadelphia, 1921 to date. Honorary member, Alpha Chi Sigma. Member of the American Ceramic Society, 1917, active member, 1923, Amer. Chem. Soc., Engineers Soc. of W. Pa. Published several papers on "Surface combustion" and "Water gas." Contribution to *Journal*, 1923, "Cold clean artificial gas" and a discussion upon the "General properties of gaseous fuels."

James C. Boudreau

Studied art in Boston, New York and Paris. Student in education at Columbia University and the University of Pittsburgh. Student in ceramics at the University of Pittsburgh and Alfred University. Served as aviator during the war. Particular interest in ceramic art education as it functions in the elementary and high schools. Became member of the American Ceramic Society in 1921, active member, 1923. Is Vice-chairman of the Art Division of this Society and Chairman of the Committee on Education of the same Division. Contribution to *Journal*, 1923, "Clay as a medium through which educational ideals may be effectively presented."



J. C. Boudreau

Now ceramist with the Carnegie Steel Company, Pittsburgh, Pa. Became member of the American Ceramic Society in 1909, active member in 1919. Chairman of the Committee on Research, Refractories Division, this Society, 1923.

A. E. Blake

Born Nashua, New Hampshire, 1887. Was graduated from University of New Hampshire, 1910. Assistant in chemistry, 1910–1911, Rensselaer Polytechnic Institute, Troy, N. Y. Fellow, Mellon Institute, 1911–1914. M.S. degree University of Pittsburgh, 1913. Instructor in chemistry, Carnegie Institute of Technology, 1914–1915. Fellow, Mellon Institute 1915–1917. Findlay Clay Pot Co. Fellowship,

A. E. Blake

W. F. Brown

Was graduated Cornell University 1915, specialized in chemistry. Employed at Ball Bros. Glass Co., Muncie, Indiana. Last year of this service as chief chemist, working with R. L. Frink, then chief engineer. Chemical Warfare Service. Bureau of Standards, Optical Glass Section, for short period, leaving for

position as chief chemist, Libbey-Owens Sheet Glass Co., Charleston, W. Va. Served in this capacity four years. Now working in executive offices of that company, at Toledo, Ohio. Became member of the American Ceramic Society, 1917, active member, 1921. Representative on Committee on Nominations, Glass Division, this Society, 1923.

W. F. Brown

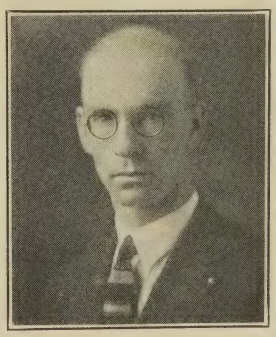
Peter P. Budnikoff

Born, 1885, Smolensk, Russia. Was graduated from the Polytechnical Institute at Riga (Chemical Section) 1911 as engineer technologist. Employed in the manufacturing of electric coals at the station Kudniows near Moscow. From 1912–1914 lectured in chemical technology at the School of Industry and Manufacture at Lodz, Poland. In 1914 was despatched to Augland by the minister of Public Instruction for scientific purposes. From 1914–1916 directed own ceramic works at Smolensk which has existed more than 150 years. In 1916 and 1917 was Administrator of the Manufactory of arms at Moscow. In 1917 voted by the council of professors at Ivanowo-Vosnessensk as docent at the Polytechnical Institute formerly at Riga. Read lectures on mineralogic technology at the Chemie faculty. In 1918 was elected professor in same section. Also read lectures on acid and fire-proof materials on technology of building materials at the Architectural faculty. A member of the scientific council of the Experimental Institute for Silicate at Moscow; German Chemical Society. Since 1918, secretary of the Journal *News of the Polytechnical Institute* at Ivanowo-Vossenensk. Contribution to this *Journal*, 1923, senior author with E. A. Shilov, "The chemistry of the terpene medium for ceramic liquid gold."

P. P. Budnikoff

Bruner Moore Burchfiel

Born in 1898 at Anthony, Kans. Received the degree of A.B. from Southwestern College, Winfield, Kans. in 1918. Was Junior Fellow on the Refractories Manufacturers' Association Fellowship at Mellon Institute in 1918 and 1919. From 1919 to 1921 was a graduate student and assistant instructor in chemistry at the University of California. Received the degree of M.S. in 1920. Since 1921 has been refractories chemist for the Los Angeles Pressed Brick Company, carrying on research work on refractories in the laboratory at their Alberhill, California, plant. Became member American Ceramic Society in 1921, active member, 1923; member of the American Chemical Society and Sigma Xi. Contribution to this *Journal*, 1923, "Refractory clays of the Alberhill, California deposits."



B. M. Burchfiel

Elmer N. Bunting

Born 1892 at Chicago, Ill. Was educated in the Chicago public schools and the University of Chicago (B.S., 1915, and Ph.D., 1918, in chemistry). During the years 1912–1918 was an assistant in chemistry at the University of Chicago, and in 1918–1919 was employed as a ceramic chemist at the Bausch and Lomb Optical Co., of Rochester, N. Y. Since 1920 has been at the University of Illinois as research associate in the Ceramic Engineering Experiment Station. Became member of this SOCIETY, 1922, active member, 1923. Contribution to *Journal*, 1923, "An electric furnace temperature regulator."

E. N. BUNTING

Frederick Carder

Born in England. Started work in father's pottery getting a practical training in all departments. Obtained position as designer in flint glass factory in England. Obtained a gold medal as well as numerous silver ones for designs in glass. Exhibited works in sculpture at the Royal Academy and was awarded a Traveling Scholarship by the Government. Became Master of a School of Art and Technology. Taught glass-making under the County Council of Staffordshire, one of the first classes in this subject in Europe. Made a report for the County Council of Staffordshire of the glass industries of Germany and Austria. Came to America to make a similar report on glass industry of the United States. In 1903, started the Steuben Glass Works with T. G. Hawkes, manufacturing artistic glass. In 1918 this Company was amalgamated with the Corning Glass Works and was made art director of same. Became member of this SOCIETY 1908 active member, 1919. Contribution to *Journal*, 1923, "Artistic glassware." Also Councilor, Art Division, this SOCIETY.

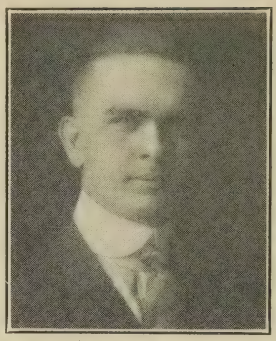
F. CARDER

Charles W. Crane

Born in New Jersey. Began business career in shipping trade with membership at present in the Maratime Exchange of New York. Financially assisted a mine of clay in 1893, saving operator from failure. 1903, incorporated the business under name of Crossman Company, now President and Treasurer of Company, South Amboy, N. J. Trustee of Manufacturers' Association of New Jersey, Vice-president, New Jersey Manufacturers' Casualty Insurance Company and of New Jersey Manufacturers' Association Fire Insurance Company. Became member of this SOCIETY, 1917, active member, 1920. Vice-president, Eastern Section, this SOCIETY, 1923.

C. W. CRANE

J. L. Crawford



J. L. Crawford

Was graduated ceramic engineering, University of Illinois, 1917. Served in Army one year during war. With Westinghouse Lamps Company eighteen months. During past four years has been Industrial Fellow at Mellon Institute, making special study of glasshouse refractories. Became member of this Society in 1916, active member, 1921. Contribution to *Journal*, 1923, "High alumina refractories."

W. J. Darby

Born at Florence, Alabama, 1900. Graduated, University of Alabama in 1922, receiving B.S. degree in Chemical Engineering. In August, 1922, was awarded a Research Fellowship at the Missouri School of Mines and Metallurgy, in coöperation with the U. S. Bureau of Mines. Now connected with the Research Division of the New Jersey Zinc Company. Joint author with B. M. O'Harra in *Journal*, 1923, "The disintegration of refractory brick by carbon monoxide."

W. J. Darby

Frank W. Davis

Born Milford, Delaware, 1889. Graduate Lehigh University. Member A. I. M. M. E., Amer. Iron and Steel Institute and Amer. Electro-Chemical Society. Eight years with the Alan Wood Iron and Steel Co. Four months with 110th Infantry, sixteen months with Ordnance Department, U. S. A. Is now metallurgist, U. S. Bureau of Mines, New York City. Contribution to *Journal*, 1923, "Outline of refractories requirements for the iron and steel industry."

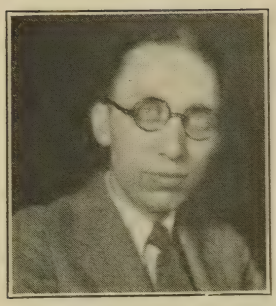
Harry E. Davis

Was graduated from Ohio State University, Department of Ceramics, 1919. Was employed with the O. W. Ketchum Terra Cotta Company, Crum Lynn, Pa. With the Northwestern Terra Cotta Company. Chicago, since 1920. November, 1923, took position as head of the terra cotta department of the Tropico Potteries Company, Glendale, Calif. Became member of the American Ceramic Society, 1919, active member, 1923. Secretary and member of Executive Committee of the Chicago Section, this Society, 1923.

F. W. Davis

Conrad Dressler

Born Streatham, England. Educated in France and England. Studied at South Kensinger and under Sir Edgar Boehm. Opened studio in Chelsea with small kiln about 1888. In 1893 started the Della Robbia pottery at Birkenhead. Built the Medmenham Pottery, 1896. Made the friezes which surround the Hall of the Law Society, the decoration for the Humphrey Museum,

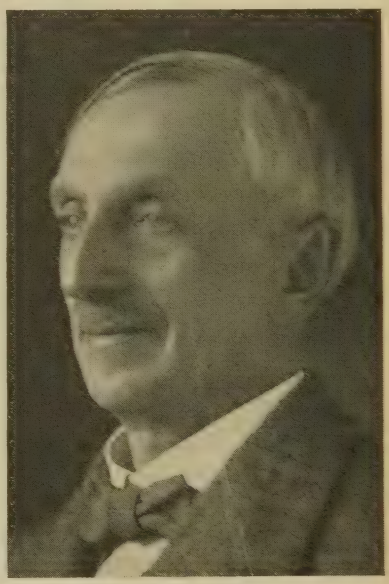


H. E. Davis

Cambridge and the Music Room, Winchester School. Worked on sculpturing 1904–1908. Returned to pottery and developed ideas on tunnel kiln. Built first industrial tunnel kiln, 1911. Dressler Tunnel Ovens Company organized. Built first Dressler tunnel kiln in America in 1915. Settled permanently in America in 1919. Actively engaged in the art of sculpture at studio in Cleveland. Became member of this Society, 1920, active member, 1921. Contribution to *Journal*, 1923, "The artistic needs of modern faïence." Member Committee on Data, Art Division, this Society.

Warren E. Emley

Received B.S. degree, University of Michigan, 1906, and degree of Ch.E. in 1912. Employed as chemist from 1906–1908, Fletcher Paper Company, Alpena, Michigan. In 1909 connected with the Technologic Branch of the U. S. Geological Survey at Pittsburgh. This work taken over by U. S. Bureau of Standards, 1910. Resigned 1917 to become Assistant to the President of the Riverton Lime Company, Riverton, Va. Returned to Bureau in Washington, 1918. Specialties, lime, gypsum and sand-lime brick. Chairman, Gypsum Committee and Secretary, Brick Committee, A. S. T. M. Honorary member Sand-Lime Brick Association since 1910. Represented U. S. Department of Commerce, Brazilian International Centennial Exposition and the A. S. T. M. at the International Engineering Congress in Rio de Janeiro. Became member of this Society in 1913, active member, 1915. Senior author of paper with E. B. Berger in *Journal*, 1923, "Panel tests of lime plaster."



Conrad Dressler

G. P. Fackt

G. P. Fackt

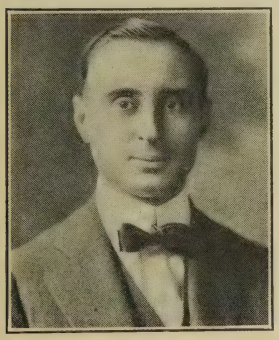
Born at Mascoutah, Illinois, 1884. Was graduated from Ohio State University, 1907, with degree of engineer of mines in ceramics. Went to work for the St. Louis Terra Cotta Company as ceramic chemist, remaining there until 1911. Organized the Denver Terra Cotta Company and was vice-president and general manager. This plant was recently purchased

by the Northwestern Terra Cotta Company. Was made president and general manager of the Denver Terra Cotta Company, which retains its identity. Became member of the AMERICAN CERAMIC SOCIETY in 1907, active member, 1919. Councilor for Terra Cotta Division, this SOCIETY, 1923.

R. F. FERGUSON

Robert F. Ferguson

Born at Everett, Pa., 1895. Graduated from the University of Pittsburgh, 1916. Served in the Chemical Warfare Service, Development Division, 1918. Junior Fellow, Refractories Manufacturers' Association Fellowship, Mellon Institute of Industrial Research, University of Pittsburgh, 1919 to date. Secretary, Refractories Division, AMERICAN CERAMIC SOCIETY, 1923. Became a member of this SOCIETY, 1918. Member Committee on Standards. Joint author with R. M. Howe in *Journal*, 1923, "Composition and properties of diaspore bauxite and gibbsite," and with R. M. Howe and S. M. Phelps, "The action of slag upon silica, magnesite, chrome, diaspore and fire clay refractories."



F. C. FLINT

Francis C. Flint

Born in Chicago, Ill., in 1891. Graduated from Pomona College in southern California, 1915. Did graduate work in the University of California. Taught chemistry in college for a while, going into research again during the war. Became member of this SOCIETY, 1919. Has been with the Hazel-Atlas Glass Company since 1920.

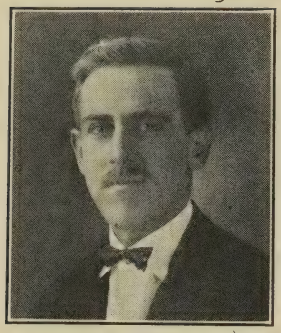
Andrew Foltz

President of the Lambertville Pottery Company. Became member of this SOCIETY, 1920, active member, 1921. President of the Eastern Section of this SOCIETY and Chairman of the Executive Committee of the same Section.

A. FOLTZ

Harry D. Foster

Born at Thornville, Ohio, in 1898. Received bachelor's degree in engineering at Ohio State University in 1920, specializing in ceramics. Employed with Mosaic Tile Company in Zanesville during 1919. Since graduation connected with the U. S. Bureau of Standards in coöperation with the Hollow Building Tile Association, on the fire-resistive and other physical properties of hollow building tile. Became member this SOCIETY, 1919, active member, 1923. Member of the A. S. T. M., Committee C-10 on Hollow Building Tile. Contribution to *Journal*, 1923, "Capping for



H. D. Foster

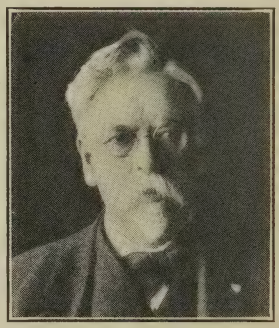
compression specimens," and "Effect of grog addition on the fire resistance of hollow tile."

Frank F. Frederick

Director, The School of Industrial Arts, Trenton, N. J. Contribution to *Journal*, 1923, "School of Industrial Arts," City of Trenton.

Myrtle Merritt French

Was graduated from the New York State School of Clay Working and Ceramics at Alfred University, Alfred, N. Y., in 1913, receiving a B.S. degree. 1913–1914 did graduate work at same school; 1914–1915 taught in high school; 1915–1916 taught pottery in Alfred University; 1916–1920 taught pottery and weaving in Carnegie Institute of Technology at Pittsburgh, Pa. From 1921 to present time taught pottery and weaving in Chicago Art Institute. Summers and 1916 studied design at Columbia University, New York; 1917 studied ceramics at Alfred; 1918 to present time taught ceramics at Alfred. 1923 received Frank Logan medal at Chicago Art Institute for pottery. Contribution to *Journal*, 1923, "The problem of the turquoise alkaline glaze."



F. F. Frederick

C. E. Fulton

Was graduated from Rutgers College, 1911, B.S. degree in ceramics. Held ceramic fellowship at the University of Illinois, 1911–1912. Became laboratory assistant in the research department with the Pittsburgh Plate Glass Company in July, 1912. January 1, 1917 to present time, chief engineer with the same Company. Became member of the American Ceramic Society 1911, active member 1915. Member of Committee on Standards (Products) for the Glass Division, this Society, 1923. In recent years a contributor to the *Journal*.

Myrtle M. French

T. W. Garve

Graduate mechanical engineer. Joined the Richardson-Lovejoy Engineering Company in 1907 after previous experience as machinist and designer, continuing with the Lovejoy Engineering Company until 1916. During the latter years took the ceramic course at Ohio State University. Practical experience as burner on continuous and periodic kilns with the Hebron Fire & Pressed Brick Co., Hebron, N. Dak., Waynesfield Tile Works, Waynesfield, Ohio, and the Barbourville Brick Company, Barbourville, Ky. During 1917 was in charge of the shop and business of the Ceramic Supply & Construction Co., Columbus, O., then designer for the Atlas Portland Cement Company, Northampton, Pa., the Findlay Clay Pot Company, Washington, Pa., and the Chain-Belt Company, Milwaukee,

Wis. During 1919, 1920, 1921 and 1922 was construction engineer for the Franklin Brick & Tile Co., Columbus, Ohio, and then for the Clay Products Company of America, New Hope, Pa. During summer, 1922, in charge of burning and kiln remodeling for the Paxtonville plant of the Watsontown Brick Company, Watsontown, Pa. From fall 1922 until fall 1923 construction engineer for the combined plants of the Franklin Brick & Tile Co., Columbus, Ohio, and the Clay Products Company, Brazil, Ind. At present with the Findlay Clay Pot Company, Washington, Pa. Became member of the American Ceramic Society in 1910, active member in 1913. Contribution to *Journal*, 1923, "Construction features of importance to clay plants."

T. W. Garve

G. P. Gavin

Received technical training, Lane Technical School, Chicago, Illinois. Assisted in several potteries in Chicago and the East. From New Jersey took position as superintendent of the Kalamazoo Sanitary Manufacturing Company, Kalamazoo, Mich. Contribution to *Journal*, 1923, with F. M. Hartford, "A recent installation of a Harrop tunnel kiln."

C. F. Geiger

Charles F. Geiger

Graduate, ceramic engineering, University of Illinois. Research assistant in same department one year. Instructor in ceramics, Rutgers College, two years. Located at Camp Dix, New Jersey and U. S. Bureau of Standards, Pittsburgh for investigative work on airplane spark plugs, light aggregate for concrete ships during the war. Employed with the Carborundum Company, Niagara Falls in 1919 for research and application work on silicon carbide and clay refractories. Transferred to refractories division, same Company, Perth Amboy, N. J. in 1920 as refractories engineer in the production and application of silicon carbide and other superior refractories, high temperature cements, fire clay refractories, etc. Became active member this Society, 1920. Contribution to *Journal*, 1923, "The history of the development of silicon carbide refractories."

R. F. Geller

Born in Fowler, Michigan, 1895. Received B.S. degree in chemical engineering in 1918, University of Michigan. Since leaving the University has been connected with the Bureau of Standards; is now chief of the Refractories Section of the Ceramic Division. Became member, this Society, 1919, active member, 1921. Is now chairman of the Committee on Stand-

R. F. Geller

ards. Active member of the A. S. T. M. and is at present a member of Committee C-8 on Refractories and Committee C-10 on Hollow Building Tile. Contributions to *Journal*, 1923, "Progress report on specifications for refractories." Senior author with A. N. Finn, "Further studies on cast glass pots."

Horace W. Gillett

Born Steuben County, N. Y., 1883. Received degrees of A.B., 1906 and Ph.D., 1910, Cornell. Assistant chemist, Cornell, 1906–1907; chemist, A. D. Little, Inc., 1907–1908; assistant in chemistry, Cornell, 1908–1910; manager, research department, Aluminum Castings Company, 1910–1912. From 1912 to present time chief alloy chemist, U. S. Bureau of Mines, New York City. Member, Chemical Society, Electrochemical Society, Mining Engineers and British Institute of Metals. Contribution to *Journal*, 1923, "Metallurgical requirements of refractories for furnaces melting copper alloys."

A. A. Granger

Albert Alexander Granger

Born at Paris in 1866. Began career at the Faculté des Sciences of Paris in the laboratory of chemical researches. Was assistant of analytic chemistry 1889–1891. Became professor of ceramic technology and chemistry at the Ceramic School of the Sèvres Manufactory in 1894 at the time of the creation of this school. Received degree of Doctor of Science, 1898. Lecturer for ceramic glass and cement at the École Municipale de Physique et Chimie Industrielles de la Ville de Paris, 1902–1914. Chief of the testing laboratory of the Manufactory at the Sèvres Laboratory, 1909. First researches bore upon inorganic chemistry; at Sèvres spent entire time with questions concerning ceramic and glass industry. Contribution to *Journal*, 1923, "The ceramic industry of France at the end of the 19th century."

Flemmon Porter Hall

Received B.E. degree in 1918 from Vanderbilt University. Was employed at a Government Powder Plant as chemist during 1918. Was employed at Bureau of Standards in the Ceramic Division during 1919–1920. Received S.M. degree from Massachusetts Institute of Technology in 1921. Up until October 1 this year was employed as associate chemist at Bureau of Standards in Ceramic Division. Is now taking graduate work in the department of physical chemistry, Massachusetts Institute of Technology. Became member of this Society, 1921, active member, 1923. Contribution to *Journal*, 1923, "Effect of hydrogen ion concentration upon clay suspensions."

F. P. Hall

Carl B. Harrop

Engineer of Mines, Ohio State University, 1902; Assistant chemist, Bronson Portland Cement Co., Bronson, Mich., 1902; assistant chemist, National Portland Cement Co., Durham, Ontario, 1903; chief draftsman with W. D. Richardson, brickworks engi-

neer, Columbus, Ohio, 1904; secretary, The Richardson-Lovejoy Engineering Co., Columbus, Ohio, 1905–1910; estimator, The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio, 1907–1910; secretary, treasurer and manager, the Ceramic Supply & Construction Co., Columbus, Ohio, 1910–1913; vice-president, the Richardson-Lovejoy Engineering Co., 1913–1916; part-time instructor of ceramic engineering, Ohio State University, 1910–1913; assistant professor of ceramic engineering, Ohio State University, 1913–1923; in private consulting engineering practice, specializing on continuous tunnel kilns, since 1918. Became member of the American Ceramic Society, 1914, active member, 1917. Chairman, Committee on Rules, Heavy Clay Products Division, this Society, 1923.

C. B. Harrop

Theodore D. Hartshorn

Born in Kensington, Md. Graduated from Dartmouth College in 1921 with B.S. degree in Chemistry. In 1918, employed in Chemical Warfare Service, Washington, D. C. In 1920, employed by Hooker Electrochemical Company, Niagara Falls, N. Y. For the past two years connected with the Enameled Metals Section, U. S. Bureau of Standards, Washington, D. C. Joined American Ceramic Society in 1922, became active member in 1923. Chairman of Committee on Data of the Enamel Division, this Society for 1923.

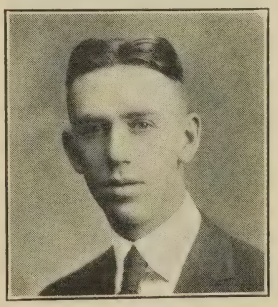
T. D. Hartshorn

Frank M. Hartford

Born, New Philadelphia, Ohio, 1897. Received engineering education, 1916–1918, Ohio State University. Employed with the Chelsea China Company, New Cumberland, W. Va., and since that time associated with Carl B. Harrop, Engineers and Constructors, Columbus, Ohio. Became member of the American Ceramic Society, 1920, active member, 1923. Joint contributor to *Journal*, 1923 with G. P. Gavin, "A recent installation of a Harrop tunnel kiln."

Fred T. Heath

Born, Tacoma, Wash. Entered University of Washington, Seattle, Wash. in 1915 studying architecture. Commissioned in Coast Artillery Corps and transferred to Air Service as observer during the war. Reentered the University of Washington in the newly established ceramics department. Received B.S. degree in 1922, the first degree in ceramic engineering granted at that University. Associated with Prof. Hewitt Wilson during survey of clays and the ceramic industry of the Northwest. Spent one year conducting research stud-



F. M. Hartford

ies in the hollow building tile design with the Heath Unit Tile Company, Tacoma. Received ceramic research fellowship sustained jointly by the Ceramic Station, U. S. Bureau of Mines, of Columbus and the Engineering Experiment Station, Ohio State University, conducting research pertaining to heavy clay products until June, 1924. Became member this Society, 1919, active member, 1923. Joint author with Hewitt Wilson and A. L. Bennett, *Journal*, 1923, of paper entitled, "Preliminary report on residual kaolin and feldspar in the Pacific Northwest."

F. T. Heath

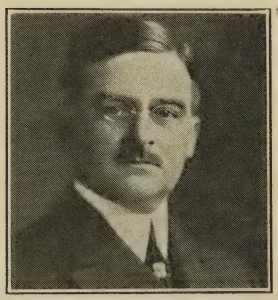
Perry D. Helser

Born at Thornville, Ohio, in 1893. Graduated in Ceramic Engineering from the Ohio State University in 1917. One year, Ceramic Engineer with Mosaic Tile Company of Zanesville, Ohio. One year's service as Lieutenant in the Chemical Warfare Service, U. S. A., manufacturing toxic gas at Edgewood Arsenal, Edgewood, Md. Up to the present time connected with the A. C. Spark Plug Company of Flint, Mich., as ceramic engineer. Joined American Ceramic Society, 1917. Vice-chairman, Detroit Local Section, this Society, 1923.

P. D. Helser

Henry W. Hess

Received early training at Toledo High Schools and Scott Manual Training. Graduated from University of Michigan and took post graduate work there. Was first associated with the Toledo Gas Light and Coke Company and for many years with the Libbey Glass Company. For past three years has been consulting chemical engineer in glass, ceramic and fuel industries, Toledo. Became member of the American Ceramic Society, 1918, active member, 1921. Contribution to *Bulletin*, 1923, "Observations on the European glass industries."



H. W. Hess

L. C. Hewitt

Received degree of B.S. in ceramics, Iowa State College, Ames, Iowa, in 1917. Conducted experimental work for Iowa State Geological Survey during the summer of 1917, followed by work with the Laclede-Christy Clay Products Company at St. Louis, Mo. conducting research work in humidity drying. Since February, 1921, has occupied the position of ceramic engineer for the same company, having charge of the research work connected with the development and application of refractories, specifications for drying clays, composition of mixes and processes of manufacturing. Became member of the American Ceramic Society in 1919, active member in 1923. Contribution

to *Bulletin*, 1923, "Notes on the burning of refractories with special reference to control of labor costs."

L. C. Hewitt

Charles W. Hill

Born in Clarion, Iowa in 1884. Graduated in chemistry, University of Minnesota, 1905. Received M.A. degree, 1907, and Ph.D. degree in 1910 in inorganic and physical chemistry at the University of Wisconsin. Instructor in chemistry at Wisconsin and associate professor of chemistry at the University of Syracuse. Chemist for St. Paul Gas Company, Laclede Gas Company. Assistant director of Research Laboratories, National Carbon Company. Research chemist in charge of inorganic chemistry, Westinghouse Research Laboratory. One of the founders of the Cleveland Research Laboratory and the Cleveland Electro-Metals Company. Since 1920, General Works Manager for the Atlantic Terra Cotta Company. Has published largely in this *Journal* and other technical publications. Has taken patents on various arc carbons, solders and an indicator and control for furnace atmospheres. Main interest for several years in technical control of factory processes. Active member this Society since 1920. Chairman of Committee on Standards, Terra Cotta Division.

C. W. Hill

E. C. Hill

Received degree of ceramic engineer from Ohio State University, 1911. Employed in the research department of the Pittsburgh Plate Glass Company from 1911 to 1912. Ceramist with the New York Architectural Terra Cotta Company, Long Island City, N. Y., 1912–1919. Ceramist with the Conkling Armstrong Terra Cotta Company, Philadelphia, Pa. Active member of the American Ceramic Society since 1912. Chairman of Committee on Data and representative on Committee on Nominations of Terra Cotta Division of Society, 1923.

E. C. Hill

Roy A. Horning

Born at Hutsonville, Illinois. Was graduated from the University of Illinois, Ceramics Department, 1914. Employed 1914 to 1916 by Armstrong Cork Co., Beaver Falls, Pa., doing research work on heat transmission. Entered service May 1917, commissioned in Engineer Corps, later commissioned first lieutenant in Coast Artillery, went to France with 50th Artillery in 1918. Discharged from the army June, 1919. Returned to the Armstrong Cork Co., Beaver Falls, Pa., and devoted most of the time to efficiency work. Manager of the Lancaster Brick Co., Lancaster, Pa. Became member of the American Ceramic Society, 1916, active member, 1919. Contribution to *Journal*, 1923, "Experiences with Dutch kilns."

R. A. Horning

William Otis Hotchkiss

Born Eau Claire, Wis., 1878. Received degrees of B.S., 1903, C.E., 1908, Ph.D., 1916, from the University of Wisconsin. Economic geologist, Wisconsin Geological and Natural History Survey since 1907, director since 1919. State geologist since 1909. Contribution to *Journal*, 1923, "Geology of the Baraboo ganister deposits."

W. O. Hotchkiss

Herbert Insley

Was graduated from Hamilton College in 1914 and received degree of Ph.D. from the Johns Hopkins University in 1919, specializing in geology. Has been an associate geologist with the U. S. Geological Survey and a petrologist with the U. S. Bureau of Mines. At present he is petrographer for the U. S. Bureau of Standards. Is engaged in research on the constitution of ceramic raw materials and products. Became a member of the American Ceramic Society, 1922, active member, 1923. Fellow of the Mineralogical Society of America and a member of the Geological Society of Washington. Contribution to *Journal*, 1923, "A study of the origin and cause of stones in glass."

H. Insley

R. B. Keplinger

Received A.B. degree, Cornell, 1911. Ceramic work, University of Illinois, 1913 and 1914. With Metropolitan Paving Brick Company from 1911 to present time as time keeper, superintendent, general superintendent and assistant general manager. Became member of the American Ceramic Society, 1914, active member, 1920. Is Chairman of Heavy Clay Products Division, this Society, 1923.

R. B. Keplinger

R. M. King

Born and reared in Texas. Entered University of Texas in 1912 taking B.A. in chemistry 1916. Chief chemist Alcoa Tennessee Works, Aluminum Company of America for three years. Research Engineer in Electrode Plants, Badin, N. C., and Niagara Falls Works

Aluminum Company of America for two years. Production Superintendent of Carbon Electrode Plant, Alcoa Tennessee Works Aluminum Company of America for one year. Studied ceramics at Ohio State University from Feb., 1922 to June, 1923, taking the degree of Master of Science. Now doing development work for American Lava Corporation, Chattanooga, Tennessee, in coöperation with the U. S. Bureau of Mines Ceramic Station, Columbus, Ohio. Became member of the AMERICAN CERAMIC SOCIETY, 1923. Contribution with A. S. Watts to *Journal*, 1923, "The transfer of heat through refractories and its determination."

A. A. KLEIN

R. M. KING

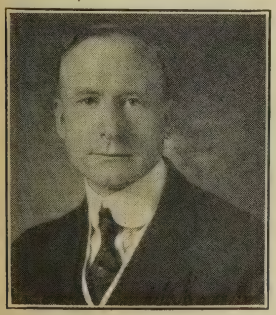
A. A. Klein

Born, Syracuse, N. Y., 1889. Employed with Semet-Solvay Company, 1906–1907. Attended the University of Michigan 1907–11. Assistant in mineralogy, 1908–1911. With Bureau of Standards, 1916. With Norton Company, Worcester, Mass., 1916 to date. Active member of AMERICAN CERAMIC SOCIETY since 1912. Councilor, New England Section, this SOCIETY, 1923. Joint author with M. C. Booze to *Journal*, 1923, "A rapid means for the determination of the quartz content of feldspar."

H. F. KRIEGE

Herbert Frick Kriege

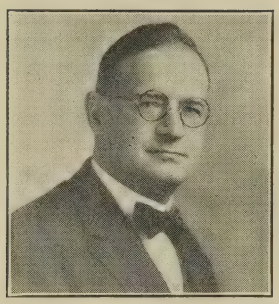
Born, Omaha, Nebr., 1895. Received B.S. degree Central Wesleyan College, Mo., 1916; A.M. University of Missouri, 1921; post graduate University of Missouri. Taught Iowa High Schools, 1916–1918. Served with Coast Artillery Aug., 1918–Jan., 1919. Instructor, analytical chemistry, University of Mo., 1921–1923. At present chemist with Missouri State Highway Commission. Contribution to *Journal*, 1923, "Effect of time and temperature on the chlorination of flint fire clay."



J. B. KRAK

J. B. Krak

Was graduated Fresenius' Laboratory, '07. Received B.S. degree from West Virginia University, 1912. Chemist, West Virginia Geological Survey, 1908–1920. Consulting chemist, United States Window Glass Company, 1914–1920. Technical editor of *The Glass Industry* since 1920. Became member of the AMERICAN CERAMIC SOCIETY, 1921, made active mem-



J. D. LALOR

ber, 1923. Contribution to *Journal*, 1923, "The glass industry."

James D. Lalor

Born in Philadelphia in 1870. Received engineering education under private tutor. Occupied for twenty years with construction work around Philadelphia. Chief engineer and built the Philippine Exposition at Louisiana Purchase Exposition, 1903–1904. In 1909, developed the Lalor Automatic Shut-off and Drain Valves for the protection o fuel oil systems, with factory established in Baltimore, 1913. In 1920, placed Lalor Fuel Oil System on the market. Contribution to *Journal*, 1923, "How to install and operate a fuel oil system."

C. H LAWSON

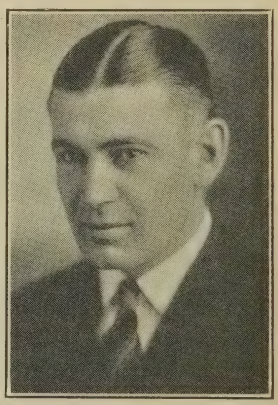
Carl H. Lawson

Born, Fall River, Mass., 1893. Entered the employ of the Norton Company, Worcester, Mass., in 1908. Served apprenticeship five years in the plant. In 1913 entered the research laboratory of the same company under Ross C. Purdy (then research director). Eight years on factory research work. Superintendent of the Waltham Grinding Wheel Company since 1921. Became member of the AMERICAN CERAMIC SOCIETY, 1917; active member, 1923. Secretary-Treasurer of the Northeastern Section this SOCIETY, 1923.

T. LENCHNER

Theodore Lenchner

Born, New York City, in 1888. Graduated Pennsylvania State College with degree of B.S. in 1912. From 1912 to 1914 with the American Vanadium Company. From 1914–1920, superintendent with the O. Hommel Company, Pittsburgh, Pa., consulting chemist, 1920–1922. Accepted position with the Vitro Manufacturing Company in summer of 1922. Became member of the AMERICAN CERAMIC SOCIETY, 1923. Contribution to *Journal*, 1923, "Glass decorators' palette and its decoration."



P. C. LEONARD

Phil C. Leonard

Born, Joliet, Ill., 1892. Was graduated, 1916, from Lombard College, B.S.degree. Served three years as by-product foreman Dover By-Product Coke Co.,

Dover, Ohio; two years silica work at Joliet for American Coke & Chemical Co., and about three and one-half years with American Refractories Co. Sales work, in charge Chicago office last year before consolidating with present General Refractories Company. At present a salesman with this Company. Became member of the AMERICAN CERAMIC SOCIETY, 1923. Representative on Committee on Nominations, Refractories Division, this SOCIETY, 1923.

J. T. LITTLETON, JR.

Jesse Talbot Littleton, Jr.

Born, Belle Haven, Va., 1887. Received A.B. degree Southern University (Alabama), 1906; fellow, Tulane, 1906–1908, A.M. degree, 1908; Ph.D. degree, University of Wisconsin, 1911. Instructor, University of Michigan, 1911–1913. Since 1913, chief, physical laboratory, Corning Glass Works, Corning, N. Y. Research work centered upon optical constants of metals, alloys and steels, and the mechanical and physical properties of glass. Member, A. A. A. S. and the Physical Society. Contribution to *Journal*, 1923, "The relative magnitude of radiation and convection heating in a muffle kiln."

A. MALINOVSKY

A. Malinovsky

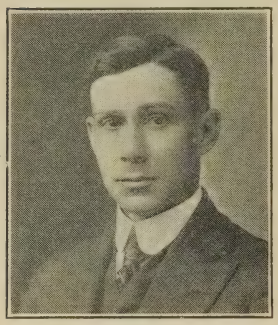
Born at Vienna, Austria, in 1875. Worked in father's plant where stove tile, floor tile and enameled ware was manufactured. Finished the State Real and Gymnasium School at Lauban, Germany. Received instructions in ceramics, and has been employed in different countries in Europe in manufacturing refractory porcelain and enameled sanitary and kitchen utensils. In America has been employed by Randolph and Co., Chicago, Ill. as chemist, developing processes and soils, with the Malinite Co., Belleville Ill., Blackmer and Post, St. Louis, Mo., U. S. Smelting Furnace Co., Belleville, Ill. At present is employed at the Washington Iron Works, Los Angeles, Calif. Has designed and remodeled enameling plants and has done consulting work. Became member of the AMERICAN CERAMIC SOCIETY in 1915; active member, 1923. Is a member of the American Institute of Chemical Engineers, Advance of Science, Illinois State Academy, American and British Ceramic Society, Chairman of the new California section of this SOCIETY. Contribution to *Journal*, 1923, "Method of cooling enamel by compressed air."

M. E. MANSON

Mahlon E. Manson

Born, Terre Haute, Ind., 1895. Graduated from Rose Polytechnic Institute, 1916. as chemical engineer.

Worked as a chemist after graduation for Armour & Co. and Butte & Superior Mining Co. before entering the army. Served overseas with 90th Division. After discharge, worked in Sears-Roebuck laboratory until coming to the Rundle Manufacturing Co. in 1920 as chief chemist. Active member of this SOCIETY since 1921. Contribution to *Journal*, 1923, "The use of bentonite for suspending enamels."



J. D. MARTIN

John D. Martin

Born 1880, Cleveland, Ohio. Was graduated from Ohio State University, 1901, degree Mechanical Engineer. With Pennsylvania Railroad 1901–1904 as special apprentice, motive power department during part of which time acted as member of locomotive testing department at St. Louis Exposition. In June, 1905, took charge of plant of Straitsville Impervious Brick Company, of Thomas Moulding Brick Company, New Straitsville, Ohio. In 1915 also took charge of plant of Buckeye Fire Brick and Clay Company under same ownership, located at Scioto Furnace, Ohio. Is voter in the SOCIETY for the Straitsville Impervious Brick Company, corporation member. Contribution to *Journal*, 1923, "Automatic kiln stokers."

George E. Middleton

Born January, 1890, in Washington, D. C. Received degree of Ceramic Engineer from Ohio State University, 1912. Chemist, Northern Clay Co., Auburn, Washington, 1912–1913. Assistant examiner U. S. Patent Office, 1913–1919. Attended George Washington University, 1913–1916, receiving degree of B.A. Attended George Washington University Law School, 1916–1919. Assistant in patent department of Norton Company, Worcester, Mass., 1919–1920. Associated with the patent law firm of Pennie, Davis, Marvin & Edmonds, 165 Broadway, New York City, from 1920 to the present time. Became member of the AMERICAN CERAMIC SOCIETY, 1914; active member, 1923. Contribution to *Bulletin*, 1923, "Inventions and patents —some phases of the patent law."

Robert J. Montgomery

Was graduated from Ohio State University in 1911 with the degree of Ceramic Engineer. Until 1915 studied and manufactured glass house refractories in the research laboratory of the Pittsburgh Plate Glass Company. In charge of the refractories and high temperature division of the H. Koppers Company's laboratory at the Mellon Institute, Pittsburgh, 1916–1917, working on the standardization of coke oven refractories. Took the position of ceramic engineer with the Bausch and Lomb Optical Co., Rochester, N. Y., in 1917. Assisted in the development and manufacture of optical glass during that period of the war when it was so badly needed by the Army and Navy. Now in charge of the technical work connected with the manufacture of optical glass, ophthalmic or spectacle glass, both clear and colored, and the manufacture of glass pots of special composition required for this type of work. Became member of the AMERICAN CERAMIC

R. J. MONTGOMERY

SOCIETY, 1912; made active member of this SOCIETY in 1916. Contribution to *Journal*, 1923, "Opthalmic glass, a new American product."

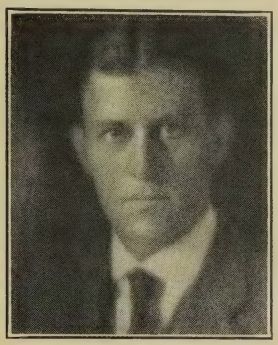
Donald A. Moulton

D. A. MOULTON

Born, Ironton, Ohio. Was graduated from Ohio State University in 1908. Became superintendent Condit Forks Brick Company, Condit Falls, Canada until 1913. With the McLain Fire Brick Company, Wellsville, Ohio, in 1920. Since that time professor in the department of ceramic engineering, Iowa State College, Ames, Iowa. Became member of the AMERICAN CERAMIC SOCIETY in 1908, now active member. Joint author with Paul E. Cox of paper in *Journal*, 1923, "A new raw material for ceramic uses."

Alexander Ector Orr Munsell

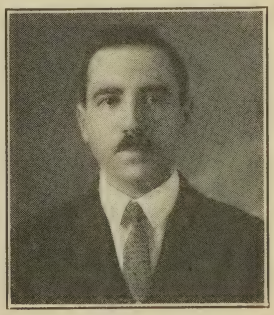
Born in Brookline, Mass., 1895. Was graduated from Harvard, 1918. Served in France nine months. Went into the Munsell Color Company which is concerned in the manufacture of Munsell color standards and supplies. Now director of the Munsell Research Laboratory, established in 1923 in memory of Albert H. Munsell, his father, the originator of the Munsell Color System. The laboratory has been located in Baltimore so that it may gain the valuable coöperation of Johns Hopkins University in Baltimore and the Bureau of Standards in Washington. Contribution to *Journal*, 1923, "Simple method of measuring color."



A. E. O. MUNSELL

Louis Navias

Born in Grodno, Russia, 1897. Received education, through high school, in Johannesburg, South Africa, matriculating from King Edward VII School in 1913. In the summer of 1914, attended the Columbia University. Transferred to the College of the City of New York, graduating in 1918 with the B.S. degree in chemistry. For two years, 1918–1920, was employed in the glass plant of the Bausch and Lomb Optical Company, Rochester, New York, doing analytical and research work in connection with optical glass. In 1920, came to the University of Illinois for graduate work. Was a Fellow for the two years, 1920–1922. He received the M.S. degree in ceramic chemistry in 1921. Made active member of Sigma Xi in 1921. Became member of this SOCIETY, 1919, active member, 1923. Contribution to *Journal*, 1923, "Measurement of heat absorbed and evolved by clays during firing and burning."



L. NAVIAS

F. P. Nickerson

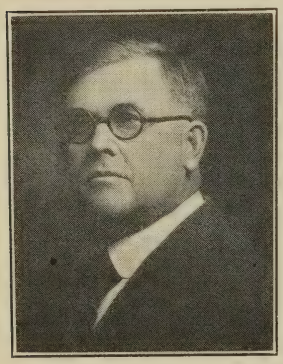
F. P. Nickerson

Born and reared in Nebraska. After completing early engineering training, entered employ to Deckman-Duty Paving Brick Company, Cleveland, Ohio. Later became field engineer with the Bonnot Company until outbreak of war. Took position of designing engineer for the General Refractories Company. Since 1920 has been employed with the W. S. Tyler Company. Became member of the American Ceramic Society, 1922. Contribution to *Journal*, 1923, "The value of screen analysis in ceramics."

B. M. O'Harra

B. M. O'Harra

Born 1894. Graduated from the South Dakota School of Mines 1915; chemist, American Smelting and Refining Company, Omaha, Nebr., 1915–1917; Research Metallurgist, American Smelting and Refining Company, Omaha, Nebr., 1917–1919; superintendent of electrolytic lead refinery and bismuth plant, American Smelting & Refining Company, Omaha, Nebr., 1919–1921; associate metallurgist, U. S. Bureau of Mines, Mississippi Valley Experiment Station, Rolla, Mo., 1921. Member A. I. M. M. E., and Am. Electrochem. Society. Contributions to *Journal*, 1923, "Metallurgical requirements for refractories in the electrothermic metallurgy of zinc," and senior author with W. J. Darby, "The disintegration of refractory brick by carbon monoxide."



F. T. Owens

Francis T. Owens

Connected with Fiske and Company, Inc., for past thirteen years. Twelve years in production end of the business. Now vice-president. Joined the American Ceramic Society, 1917; became active member, 1919. Contribution to *Bulletin*, 1923, "Importance of figuring taxes into costs."

A. R. Payne

A. R. Payne

Born in Illinois in 1891. Was graduated High School Redlands, Calif., 1909. Graduated Pomona College, Claremont, Calif., 1913, B.S. degree. Attended University of California 1913–1916 as graduate student in physics. Received M.S. degree in 1914. Taught

San Diego Night High School and Coronado High School, 1916–1917. Assistant physicist, U. S. Bureau of Standards, 1917–1919, Washington and Pittsburgh Laboratories. During war in charge of inspection of optical glass for Bureau. Chief Physicist, Hazel-Atlas Glass Company, Clarksburg, W. Va., 1919 to date. Joined the AMERICAN CERAMIC SOCIETY in 1920; became active member, 1921. Chairman, Glass Division, AMERICAN CERAMIC SOCIETY, 1923.

A. B. PECK

Albert B. Peck

Born at Syracuse, N. Y., 1892. A.B. Syracuse University, 1914., A.M. University of Michigan, 1915. Assistant in mineralogy, University of Michigan, 1914–1916. Instructor in mineralogy, University of Michigan, 1916–1917. Assistant and associate physicist, U. S. Bureau of Standards, 1917–1920, in charge of petrographic microscopic investigations of ceramic materials, assistant professor of mineralogy, University of Michigan 1920 to present time. Became member of the AMERICAN CERAMIC SOCIETY in 1920, active member, 1921. Member Sigma Xi, Alpha Chi Sigma (chemical), Fellow, Mineralogical Society, President, Detroit Section, this SOCIETY, 1923.

G. ST. J. PERROTT

G. St. John Perrott

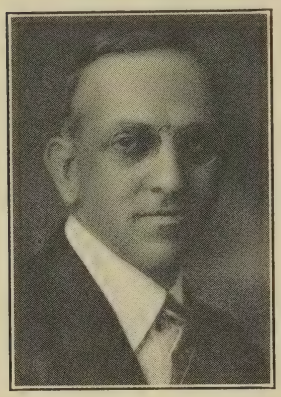
B.A., 1914, and M.A., 1915, North Dakota, physics and chemistry. Two years graduate work in physical chemistry at Princeton University. 1917–1919, Chemical Warfare Service on war gas work (1st Lieut. 1918–1919). Feb.–Oct., 1919, Bureau of Mines surveying carbon black industry. 1919–1920, at Salt Lake City with Smoke Abatement Investigation. 1920–1921, Trent Process Corporation on coöperative work with Bureau of Mines, Pittsburgh. 1921–1923, coke investigation at Bureau of Mines, Tuscaloosa, Ala., 1923. Investigation of Liquid Oxygen Explosives, Bureau of Mines, Pittsburgh. Senior author with S. P. Kinney, *Journal*, 1923, "The meaning and microscopic measurement of average particle size."

A. P. POTTS

Amos P. Potts

Was graduated as ceramic engineer from Ohio State University, 1912. Assistant professor, ceramic engineering, Iowa State College, Ames, Ia., 1912–1913, and associate professor, 1913–1914. Ceramic engineer, Mason City Brick and Tile Company, Mason City, Ia., 1914–1920. Local manager, Seguin Brick and Tile Company, McQueeny, Texas, 1920–1922. Ceramic engineer, The Clay Products Company, Brazil, Indiana, 1922 to date; loaned to the Franklin Brick and

Tile Company as acting superintendent, September, 1922 to June, 1923. Became member this SOCIETY, 1911; active member, 1914. Secretary and Chairman of the Committee on Papers and Programs, Heavy Clay Products Division, this SOCIETY, 1923.



F. R. PYNE

Francis R. Pyne

Graduated from Lehigh University in 1906 with degree of metallurgical engineer. With Boston and Montana Copper Co., Great Falls, Mont., 1906–1909. With United States Metals Refining Co., Carteret, N. J., 1909–1923. With Nichols Copper Co., Laurel Hill, N. Y., at the present time as assistant general superintendent. Made various contributions to the technical press and engineering society transactions on metallurgical subjects. Author of the articles on roasting and copper smelting in Liddell's "Handbook of Chemical Engineering." Contribution to *Journal*, 1923, "Metallurgical requirements of refractories in copper smelting and refining."

Joseph P. Rodgers

Has been actively engaged in the preparation of feldspar for the ceramic industry for the past thirty years. Experience obtained with the Brandywine Summit Kaolin & Feldspar Co., who were favorably known in the business for a great many years. For the past four years has been interested in the Product Sales Co., and he is also treasurer of the Clinchfield Sand & Feldspar Co. Chairman, of Committee on Standards (Tests) in White Wares Division, this SOCIETY, 1923. Became member of the AMERICAN CERAMIC SOCIETY, 1922.

J. P. RODGERS

Charles I. Rose

Born in St. Louis, Mo. in 1901. Received an M.S. degree in Ceramics, and a B.S. in Chemical Engineering at the University of Illinois. Since graduation has been employed in research work on abrasives. Became a member of the AMERICAN CERAMIC SOCIETY, 1922, also American Chemical Society. Contribution to *Journal*, 1923, "Proposed method for studying the attack of molten slags and glasses upon refractory materials."

A. D. SABORSKY

Arthur D. Saborsky

Born in Vienna. Spent the earlier business years in Europe. After graduating from the Engineering College in Berlin, worked for Austrian, German, Italian and English firms, finally settling permanently in the United States. Adopted the engineering of special purpose machinery as particular line, and has

been consulting engineer this branch ever since, located in Cleveland, Ohio. During the depression period of 1921 went to Europe on an "engineering sightseeing" trip. Examined practically all of Europe for new features of engineering, which have developed during the past years of turmoil and readjustment, but due to unbalanced conditions had not reached America. In this connection, found and investigated the progress which manufacture and use of glass wool has taken in Europe. Contribution to *Journal*, 1923, "Glass wool heat insulation in Europe."

H. A. Schwartz

Native of Oldham Co., Kentucky. Was graduated Rose Polytechnic, 1901, M.S. degree, 1903., M.E. degree, 1905. National Malleable Castings Co. at Indianapolis in 1902. Was placed in charge of the entire corporation's malleable metallurgical practice. Since 1920 Manager of Research for the same Company at its Cleveland headquarters. Author of "American Malleable Cast Iron," Member of Amer. Soc. Mech. Engineers, Amer. Chem. Soc., A. I. M. M. E., Society of Automotive Engineers, British Iron and Steel Institute, Amer. Foundrymen's Assoc. Senior author with A. F. Gorton, *Journal*, 1923. "The requirements of fire brick suited to malleable practice."

Carl Schwier

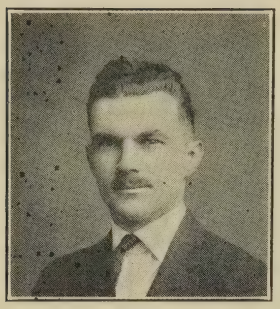
Born in Mansfield Ohio, 1898. Attended college at Western Reserve University and Case School of Applied Science at Cleveland and graduated with a degree of A.B. from the former institution and a B.S. in chemical engineering from the latter in June, 1921. In 1918, spent some months at Camp Zachary Taylor and was commissioned Second Lieutenant in Field Artillery. Entered the employ of the Mansfield Vitreous Enameling Co. in 1921 and for four months worked in all departments of the plant doing all operations in the wet enameling of sheet steel and cast iron. Since that time has remained with the same firm in the capacities of chemical engineer and superintendent and is the present plant superintendent. Joined the American Ceramic Society, 1921. Became active member, 1923. Contribution to *Journal*, 1923, "An electric furnace for vitreous enameling."

C. Schwier

Mary G. Sheerer

Mary G. Sheerer

Born in Kentucky. Studied drawing and painting, Cincinnati Art Academy. Received scholarship to Frank Duveneck's class in oil painting from life and other teachers. Teacher and assistant director, Newcomb Pottery, New Orleans. Became member of the American Ceramic Society, 1922. Member Arts and Craft Association. Contribution to *Bulletin*, 1923, "Exhibition of industrially made table ware." Also Councilor Art Division of this Society.



M. Sheppard

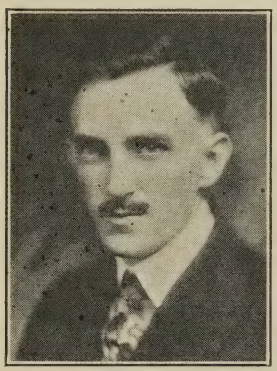
Mark Sheppard

Received B.S. in Ceramic Engineering, Alfred University, 1919. Industrial Fellow, Mellon Institute of Industrial Research, 1919–1921. Ceramic Engineer, E. J. Lavino and Company, 1921–1923. Joined the American Ceramic Society in 1920; became active member, 1923. Contribution to *Journal*, 1923, "Zirconia Refractories."

H. H. Sortwell

H. H. Sortwell

Born at Lawrenceburg, Ind. Was graduated from University of Illinois in ceramic engineering in 1918. Entered Navy, commissioned for engineering duty, and served overseas. Spent one year with the U. S. Encaustic Tile Works, Indianapolis. Three years at the Bureau of Standards, working on whiteware materials and problems. At present time, ceramic engineer for the Star Porcelain Company, the Frenchtown Porcelain Company, and the Washington Porcelain Company, with headquarters at the Star Porcelain Company, Trenton, N. J. Joined the American Ceramic Society, 1917; active member, 1921. Contributions to *Journal*, 1923, "The effect of variation in firing on the physical properties of vitreous china bodies" and "Impact tests on tableware."



C. D. Spencer

Charles D. Spencer

Born in Jacksonville, Florida. Attended the University of Chicago. At present associate physicist, Glass Technology Department, National Lamp Works of General Electric Co., Cleveland, Ohio. Senior author with A. E. Badger, *Journal*, 1913, "A skiagraphic study of fabricated glass articles."

Ira E. Sproat

I. E. Sproat

Was graduated Ohio State University, ceramic engineering, 1911. Ceramic engineer, three years, Dayton Grinding Wheel Company, Dayton, Ohio. Assistant Ceramic Engineer, U. S. Bureau of Mines, Washington, D. C. one year. Two years with Georgia Kaolin Company, Macon, Ga. Consulting ceramic engineer, Sebring China Company and Limoges China Company, Sebring, Ohio. Past year, manager, pottery department, R. T. Vanderbilt Company, New

York City. Joined the AMERICAN CERAMIC SOCIETY, 1912; became active member, 1920. Member American Chemical Society and A. S. T. M. Chairman of Committee on Membership, White Wares Division, this SOCIETY, 1923. Contribution to *Journal*, 1923, "Effect of heat treatment and composition of semi-porcelain bodies on crazing."

D. F. STEVENS

Douglas F. Stevens

Born in Minneapolis, Minnesota, 1893. Attended Northwestern University and Cornell University, Ithaca, N. Y. Received degree of M. E. from Cornell, 1907. Entered employment of the Acme Brick Company after graduation and has been vice-president and general manager of the Company since 1922. Became member of the AMERICAN CERAMIC SOCIETY, 1913, active member, 1921. Also member of the Illinois Clay Manufacturers Association, National Brick Manufacturers Assoc and American Face Brick Assoc. Is Chairman of the Committee on Membership, Heavy Clay Products Division, this SOCIETY, 1923.

F. L. STEINHOFF

F. L. Steinhoff

Born in Chicago, 1894. Graduated from department of ceramics, University of Illinois, 1917. Since that time connected with Industrial Publications, Inc., as field man, associate editor, and at present managing editor of *Brick and Clay Record*. Is editor of the new journal started in June, called *Ceramic Industry*. Also collaborator with the Clay Products Cyclopedia. Joined the AMERICAN CERAMIC SOCIETY, 1917; became active member, 1919. With W. D. Gates in 1917, organized Chicago Section of this SOCIETY. Is chairman of Committee on Papers and Programs, this year. Contributions to *Journal*, "The log (twenty-five years) of progress in the brick and tile industry" and "Brick and clay record, its history."

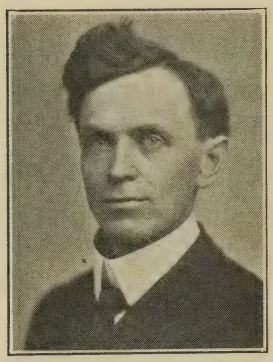
W. J. Stephani

Born in Bellville, Ill., 1881. Graduated from St. Louis Manual Training School, 1900, Ohio State University, 1900–1903. Excelsior Terra Cotta Co., 1904–1906. Planned and built O. W. Ketcham Terra Cotta Works, 1906. Associated at this time there. Joined the AMERICAN CERAMIC SOCIETY, 1906; became active member, 1912. Councilor, Terra Cotta Division, this SOCIETY, 1923.

W. J. STEPHANI

C. O. Swanson

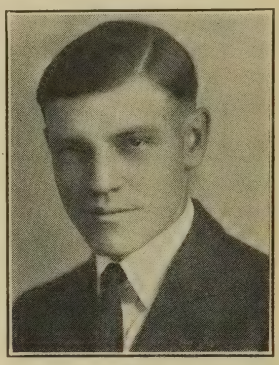
Received A.B. degree Carleton College, Minn., 1899, M.Agr. 1905, College of Agriculture, University



C. O. Swanson

of Minnesota; Ph.D., 1922, Cornell University. Teacher of science and Agricultural Chemistry. Head of Department of Milling Industry, July, 1923 to present time. State Agricultural College, Manhattan, Kans., Jan. 1918–July 1919, technologist in cereal dust explosion work with the U. S. Dept. of Agriculture, Bureau of Chemistry. Contribution to *Journal*, 1923, "The origin, distribution and meaning of laterite."

Mark A. Taylor



M. A. Taylor

Received degree of B.S. in ceramic engineering at Iowa State College in 1921. One year (1919–20), served as despatcher and chief despatcher, Christy Plant of the Laclede-Christy Company, of St. Louis, Mo. This work was under the direction of Dwight T. Farnham, industrial engineer. Since July, 1921, has been employed by the Vincent Clay Products Company of Fort Dodge, Iowa, as ceramic engineer. At present has charge of the drying, setting, and kiln burning departments. Became member of this Society, 1922. Contribution to *Journal*, 1923, "Fuel oil as adapted to the chambered continuous kiln."

G. E. Thomas

George E. Thomas

Educated in mechanical lines, spent several years studying the production and manufacture of glass house refractories under father, a clay working and mining engineer from the Starbridge Clay fields, England. Has been connected for fifteen years with the Highlands Fire Clay Company, St. Louis, Mo., is general manager and superintendent. Member of the American Ceramic Society, 1911, active member in 1923. Chairman, Membership Committee, St. Louis local section, this Society.

Frederick S. Thompson

F. S. Thompson

Degree of Bachelor of Arts from Defiance College and degrees of B.S. and chemical engineer from Case School of Applied Science. Teacher and principal of high school at Le Grand and Colton, Cal., 1913–1917. Assistant manager, Rhode Island Division of the National Lamp Works of the General Electric Co., 1917–1923. Since February of 1923

with glass technology department of same company, Nela Park, Cleveland. Contribution to *Journal*, 1923, "Substituting fuel oil for producer gas in a continuous glass tank."

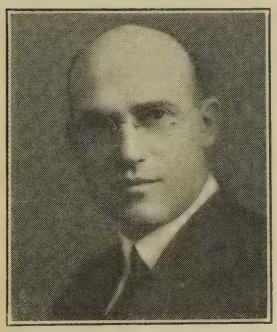
Charles B. Thwing

C. B. Thwing

Was graduated from Northwestern University and the University of Bonn. Was instructor in Physics at Northwestern and Wisconsin and Professor of Physics at Knox College and Syracuse University. Author of two textbooks on physical measurement and of numerous contributions to scientific periodicals. Since 1906 has been engaged in the manufacture of pyrometers and other scientific instruments at Philadelphia. Has invented numerous improvements in pyrometry and has specialized in pyrometers for the ceramic industry. Became member in the Society, 1917. Contribution to *Journal*, 1923, "Cold end compensation of a pyrometer system."

Karl Turk

Received initial training in enameling under Theodore Zwerman, Sr., of the Baltimore Enamel and Novelty Company. Worked with the "wet" process for cast iron, particularly stove work. Vice-president, Porcelain Enamel and Manufacturing Company of Baltimore, vice-president, Wolverine Porcelain Enameling Company, Detroit, Mich., and the Scranton Enameling Company, Scranton, Pa., all operating under the "Penn." System. Joined American Ceramic Society, 1917; became active member, 1921. Chairman, Membership Committee, Enamel Division, this Society, 1923.



Karl Turk

Robert Twells, Jr.

Born in Independence, Ohio, 1895. Worked at sanding molds and in various capacities in plants making sewer pipe, hollow blocks, paving and common brick. In 1914, worked for the Key-James Brick Company, Chattanooga, Tennessee, as foreman of shipping department. Withdrew from the University of Illinois to enter Army service in May, 1917. Was graduated with B.S. degree in ceramic engineering in 1920. Member Tau Beta Pi and Sigma Tau, honorary engineering fraternities, and Keramos, honorary ceramic fraternity. Worked with the General Electric Company, Schenectady, N. Y. Since 1921 employed with the Champion Porcelain Company, now assistant superintendent. Member in Society since 1920. Chairman, Membership Committee, Detroit Section, this Society. Contributions to *Journal*, 1923, "Further studies of porcelain glazes, maturing at high temperature" and "Tests on some sagger clays and bodies."

R. Twells, Jr.

C. A. Underwood

C. A. Underwood

Was graduated in 1915 from the Worcester Polytechnic Institute. Afterwards served one and one-half years in field of organic chemistry. Associated with Harbison-Walker Refractories Company three years as chemist and representative in the magnesite field in state of Washington. Served in Chemical Warfare Service during war. Later was chief chemist for American Refractories Company three and one-half years. At present connected with sales department of Queen's Run Refractories Co. Became member of the American Ceramic Society, 1922, active member, 1923. Contribution to *Journal*, 1923, "The analysis of refractories," and to *Bulletin*, 1923, "The analysis of high alumina products."

James G. Vail

Was graduated from Westtown School, Philadelphia, 1904. Became chemist with the Philadelphia Quartz Company; now secretary and chemical director of same company. Took additional work at the University of Pennsylvania, Harvard University and the Institute of Technology in Darmstadt, Germany. Under American Relief Administration directed feeding of under-nourished children in Hamburg, and shipment of supplies into Germany. Member of American Ceramic Society, 1922; American Institute of Chemical Engineers, Society of Chemical Industry, and the American Chemical Society. Contribution to *Journal*, 1923, "Silicate of soda in the ceramic industry."

J. G. Vail

A. S. Walden

Has been employed with the National Carbon Company, Inc., Cleveland, Ohio, in the production and engineering departments for twenty-eight years. Became member of the American Ceramic Society, 1917, active member, 1919. Chairman of the Executive Committee of the Northern Ohio Section, this Society, 1923.

A. S. Walden

Robert A. Weaver

Graduate of Kenyon College. Instructor of English and director of athletics, DoVoe College one year. Assistant sales manager and advertising manager of Eclipse Stove Company for two years, Advertising manager for the Favorite Stove and Range Company for two years. Sales manager for the Porcelain Enamel and Manufacturing Company for two and one-half years. President of the Scranton Enameling Company for one year. Vice-president, Philadelphia

Porcelain Company for two years, and president of the Ferro Enamel Supply Company four years. Joined AMERICAN CERAMIC SOCIETY, 1922. Chairman, Membership Committee, Northern Ohio Section, this SOCIETY, 1923.

R. A. WEAVER

Norman E. Webster

Attended Union College, Schenectady, N. Y. and National Law School, Washington, D. C., receiving degrees of Master of Arts and Master of Laws. Founder and president of the Association of American Government Accountants, and member of the Michigan Association of Certified Public Accountants, of the New York State Society of Certified Public Accountants, of the National Association of Cost Accountants. Now vice-president of the American Institute of Accountants. Five years as chief accountant for the United States Reclamation Service, and since 1909 as a member of Niles & Niles, Certified Public Accountants at 111 Broadway, New York City, and 53 State Street, Boston. Has given especial attention to the cost problems of the ceramic industries. Contribution to *Bulletin*, 1923, "Pricing and costing graded products."

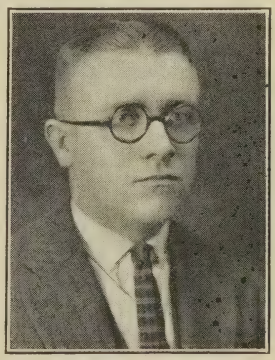
N. E. WEBSTER

Francis C. Welch

Born in Salem, Mass. in 1898. Received B.S. degree, Catholic University, 1920. From 1920–1923 worked as chemist on gypsum at U. S. Bureau of Standards. Now research associate for Gypsum Industries at the Bureau. Contribution to *Journal*, 1923, "Effect of accelerators and retarders on calcined gypsum."

W. F. Wenning

Received education in chemical engineering at Carnegie Institute of Technology and the University of Pittsburgh. Served as Ensign in the United States Navy. At present, head of research and service department, Vitro Manufacturing Company of Pittsburgh. Working on research problems which deal with the manufacture and application of chemicals for ceramic products, specializing in cast and sheet iron enamels. Joined the AMERICAN CERAMIC SOCIETY, 1921; became active member, 1923. Contribution to *Bulletin*, 1923, "Zirconia in sheet iron enamels."



W. F. WENNING

S. Wiester

Came to this country in 1912 for three months to the Enterprise Stamping & Enameling Co., Bellaire, Ohio, to abolish some faults of fabrication on kitchen utensils. Completed this work successfully and was retained by that company until 1914. Equipped the

Baltimore Stamping & Enameling Co. for white kitchenware, which department was closed down in 1916 on account of the war. Took charge of building and equipping the enameling plant of the Malleable Iron Range Company, Beaver Dam, Wis., and supervised it until 1921. In 1922, built and equipped the enameling plant for the Lackawanna Foundry Company, Dickson City, Pa. At present is with the Ironton Stove & Mfg. Co., Ironton, Ohio, to build and equip their new enameling plant, consisting of three Wiester patented fuel oil fired furnaces and to supervise the plant after it is finished. Became member of the American Ceramic Society, 1920; active member, 1923. Contribution to *Journal*, 1923, "Air-cooled *versus* water-quenched enamels."

S. Wiester

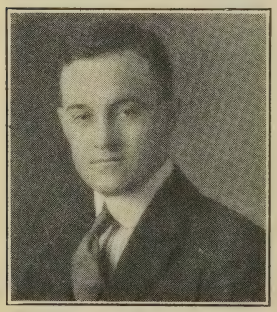
Eugene P. Wightman

Born Baltimore, Md., 1888; B.S. Richmond College, Va., 1908; Ph.D. Johns Hopkins University, Baltimore, Md., 1911; Carnegie research assistant in physical chemistry, Johns Hopkins University, 1911–1914; instructor in chemistry, Washington University, St. Louis, 1914–1915; Fellow, Mellon Institute, Pittsburgh, 1915–1916; acting professor of chemistry, Richmond College, Va., 1916–1917; research chemist, Parke, Davis and Company, Detroit, 1917–1918 and 1919–1920; 1st Lieut., U. S. A. Chemical Warfare Service, 1918–1919; research chemist, Eastman Kodak Co., Rochester, N. Y., since March, 1920. Member American Chemical Society, American Association Advertising Science, Royal Photographers Society of Great Britain, Pictorial Photographers of America. Contribution to *Bulletin*, 1923, discussion on "The meaning and measurement of average particle size."

A. G. Wikoff

Alan G. Wikoff

Received B. S. degree, College of the City of New York, 1916, majoring in chemistry. M.A. degree, Columbia University, 1917. During 1916 was associated with the Kathol Mfg. Company, then making a substitute for the photographic developer, Metol, using a process involving the electrolytic reduction of organic compounds. During 1917–1918 was chemist for the Waring Mfg. Company, Yonkers, N. Y. From April to December, 1918, with Chemical Warfare Service, assigned to mustard gas plants at Hastings-on-Hudson, N. Y. and Midland, Mich. Joined staff of *Chemical & Metallurgical Engineering*, January, 1919, as Assistant Editor. Became member of this Society, 1922. Contributions to *Journal*, 1923, "Chemical and metallurgical engineering" and "Refractory requirements for oil refining." A member of the Committee on Membership for the Refractories Division.



C. E. Williams

Clyde E. Williams

Superintendent and metallurgist, U. S. Bureau of Mines, Northwest Experiment Station, Seattle, Wash. Engaged in research work on electrometallurgy, metallurgy of iron and steel, and refractories. Contribution to *Journal*, 1923, "Requirements of refractories for electric furnaces."

G. A. WILLIAMS

George A. Williams

Born at Peffard, N. Y., 1887. Graduate of Geneseo Normal School, Geneseo, N. Y. Graduate of Alfred University, class of 1913. Professor of ceramics, Rutgers College, New Brunswick for 4 years. Altantic Terra Cotta Co., as chemist, six years. At present with Wunderlich Ltd., Sydney, Australia. Joined AMERICAN CERAMIC SOCIETY, 1921; became active member, 1923. Joint author with W. L. Howat, *Bulletin*, 1923, "Testing barium carbonate for use in terra cotta bodies."

W. S. WILLIAMS

W. S. Williams

Received B.S., University of Illinois, 1909. Practical factory experience in architectural terra cotta, floor and wall tile, optical glass, flint and window glass refractories. Became member of SOCIETY, 1919, active member, 1921. Contribution to *Journal*, 1923, "Effect of various sizes of gray particles on clay pots."

S. S. WYER

Samuel S. Wyer

Born Wayne County, Ohio, 1879. Received M.E. degree, Ohio State University, 1903. Consulting engineer since 1905. Chief of natural gas conservation, Fuel Administration, consulting engineer, U. S. Bureau of Standard, 1918, and U. S. Bureau of Mines, 1920. Member of A. A. A. S., Mechanical Engineers, Mining Engineers, American Gas Institute. Contribution to *Bulletin*, 1923, "Memorandum on power situation in United States in million horse power."

D. C. WYSOR

D. C. Wysor

Born near Dublin, Pulaski County, Virginia. Graduated from Virginia Polytechnic Institute, 1910 with B.S. degree in applied geology. Post graduate studies in geology and engineering, 1910–1911. Civil engineering on location of electrical transmission lines in Virginia and West Virginia. Assistant on Missouri Geological Survey. Mining geologist, General Chemical

Company, 1914 to date. Industrial research in this position carried on in United States, Canada and Cuba. Special work also in Western United States for Nichols Copper Company. Became member of the American Ceramic Society, 1922. Contribution to *Journal*, 1923, "Diaspore clay of Arkansas and Missouri."

A. S. Zopfi

A. S. Zopfi

Born 1874 in Sullivan County, N. Y. Educated in country schools, taught school two years. Entered employ of the Findlay Clay Pot Company, Findlay, Ohio, in 1894. In 1909 with W. K. Brownlee organized the Buckeye Clay Pot Company, Toledo, Ohio, holding office of secretary and treasurer, and still continues in such capacity. No technical degree or special training. Became member of the American Ceramic Society, 1909, active member, 1921. Chairman, Northern Ohio Section, this Society.

NOTES AND NEWS

CERAMIC DEPARTMENT OF GEORGIA SCHOOL OF TECHNOLOGY

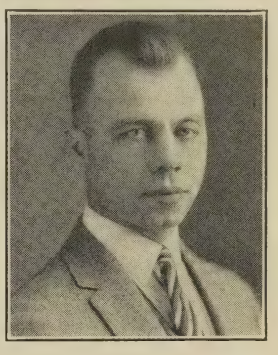
On December 3, 1923, ground was broken for the new ceramics building at Georgia School of Technology. When completed it will house the only Department of Ceramics in the South. For the present, one wing 50 feet wide and 83 feet long, will be built and equipped with a complete clay testing laboratory. Plans, however, contemplate the addition in the future of a two-floor structure, 40 feet wide and 100 feet long. Dark red rough texture brick and terra cotta will be used for construction.

Due to the enthusiastic coöperation of the clay and other industries of Georgia, $40,000 have been subscribed for equipment and maintenance. Among the contributors are the following:

Fulton County	
Cash	$10,000
Bickerstaff Brick Co.	
50,000 brick	500
J. C. Steel and Sons	
Equipment	2,000
W. G. Massee-Bibb Brick Co.	
10 carloads of brick	1,500
S. G. Warner	
Contractor's services	.....
William Wilson	
Painter's services	.....
Paint dealer of Atlanta	
Paint	200
J. B. McGrary & Co.	
Cash	500
M. C. Kiser	
Cash	200
B. Mifflin Hood Brick Co.	
Building material	$1,500
B. Mifflin Hood	
Equipment	.....
Stevens Pottery	
Firebrick	.....
Central of Georgia Railway	
Laboratory equipment	1,500
Atlanta Terra Cotta Co.	
Cash	1,000
Atlanta Chamber of Commerce	
Cash	250
Milledgeville Brick Co.	
30 carloads of brick	4,500
Edgar Brothers Co.	
Cash	500
Roper, Strauss, Ferst Co., Inc.	
40,000 sq. ft. floor tile	.....

The general assembly of Georgia, largely through the efforts of Senator Carswell, has voted the department an appropriation of $10,000 per year for maintenance beginning January.

Arthur V. Henry of Ohio State University is to be the head of the new Ceramic Department. He received the degree of Ceramic Engineer in 1914, Master of Science in 1921 and will receive the degree of Doctor of Philosophy before taking up his duties on February 1st. He has had six years' experience in the clay industry and served three years during the war as captain of artillery.



A. V. Henry

The establishment of the department is the outcome of a study of the ceramic colleges throughout the country, by Dr. Brittain, president of Georgia Tech. The investigation covered a period of more than one year and included information gathered at numerous meetings of the leaders in the clay industry.

Georgia offers a large field for ceramic research. It has vast beds of kaolins, bauxites, refractory clays, feldspars, fullers' earth and many other minerals, which for the greatest part are still undeveloped. The new ceramic department should be a big asset to the clay industries of the South.

"FUELS AND FURNACES"

Early this year, a new publication entitled *Fuels and Furnaces* in pocket size and published by F. C. Andresen & Associates, Inc., 709 House Building, Pittsburgh, Pa., made its appearance. The caliber of articles included and the Abstract Section, which is a really unusual feature in a magazine of this kind, are of sufficient merit to warrant its careful perusal by all those who are interested in industrial fuels or furnaces in the iron, steel, automotive, glass, ceramic or other industrial processes in which the subjects of fuels and furnaces is of major importance.

The success of this little publication is undoubtedly in large measure due to: the past experience of F. C. Andresen, president of the company; the wide engineering knowledge of W. Trinks, of the Carnegie Institute of Technology; E. H. McClelland, Abstract Editor and head of the Technology Department of the Carnegie Library at Pittsburgh, and of Elmer C. Cook, formerly managing editor of *Forging & Heat Treating* and the *Blast Furnace & Steel Plant.*

Some indication of the scope of this little publication may be gleaned from the titles of articles selected from the first few issues:

"Fuels and Their Handicaps as Related to Drying Ovens."
"Smoke Regulation in Metallurgical Furnaces."
"A New Radiation Pyrometer for the Measurement of High Temperatures."
"Fuel Consumption of Different Types of Furnaces."
"Coke Oven Gas Plant for the Manufacture of Sheet Glass."
"Electric Melting of Non-ferrous Alloys."
"Enameling Furnace Improved."
"Lead Pot Furnace Design."
"High Frequency Induction Furnaces."
"Furnace for Melting Glass."

"Products Yielded by Carbonization of Coal at Low Temperatures."
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"New Apparatus Successfully Controls Temperatures."
"Operating Gas Tanks."
"The Determination of Melting Points."
"CO_2 and CO Meters Described."
"Heat Balance of a Glass Tank."
"Rules for Designing Resistors."
"Japanning Department."

Fuels and Furnaces is distributed free of charge and those interested need only write the address given above giving their company name and connection to be placed on the regular mailing list.

R. C. PURDY SPEAKS IN TORONTO

Ross C. Purdy, General Secretary of the American Ceramic Society, delivered an address before the members of the Society of Chemical Industry in Toronto on the evening of Friday, December 14. Mr. Purdy's subject was "The Vitrification of Clays and Allied Problems in the Ceramic Industry."

INTERNATIONAL EXHIBITION OF MODERN DECORATIVE AND INDUSTRIAL ARTS

By H. H. Morse

An international exhibition of modern decorative and industrial arts will be held in Paris in the spring of 1925. The United States has been invited to participate by erecting at an expense of approximately $80,000 a temporary building covering about 5600 square feet of ground.

American industry is going to take an active interest and the Department of Commerce should like to know what business firms or individuals would make exhibits and to what extent they would be willing to appropriate funds for that purpose.

It is proposed that the exhibition itself will have the broadest scope and will take in all that can be produced by the artist, manufacturer and mechanic, bringing together all the decorative arts in every form. Five main groups will be represented, which are subdivided as follows:

Group I. Architecture

Class 1. Architecture.—Class 2. Stone-working (artistic and industrial).—Class 3. Wood-working (artistic and industrial).—Class 4. Metal-working (artistic and industrial).—Class 5. Ceramic-ware (artistic and industrial).—Class 6.—Glass-ware (artistic and industrial).

Group II. Furniture

Class 7. Complete suites.—Class 8. Wood and leather furniture.—Class 9. Fancy articles and articles in morocco leather.—Class 10. Artistic and household

metal goods.—Class 11. Ceramic ware.—Class 12. Cut and blown glass.—Class 13. Textile industry.—Class 14. Paper industry.—Class 15. Book industry.—Class 16. Games and toys, sporting goods and apparatus.—Class 17. Scientific instruments.—Class 18. Musical instruments.—Class 19. Means of conveyance.

Group III. Wearing Apparel

Class 20. Clothing.—Class 21. Millinery, gloves and minor articles.—Class 22. Flowers.—Class 23. Jewelry.

Group IV. Theatrical, Street and Garden Architecture and Decoration

Class 24. Scenery and stage properties.—Class 25. Objects for the adornment of streets and boulevards.—Class 26. Landscape gardening.

Group V. Educational

Class 27. Materials for school.—Class 28. Stone.—Class 29. Wood.—Class 30. Metal.—Class 31. China.—Class 32. Glass.—Class 33. Textiles.—Class 34. Paper.—Class 35. Materials of animal or vegetable origin not elsewhere classified.—Class 36. Photography and Cinematography.

NOTES FROM THE BUREAU OF STANDARDS

Tests of Caustic Magnesia Made from Magnesite from Several Sources

The results of a part of the Bureau of Standard's work on oxychloride cement are contained in Technologic Paper No. 239, which may be obtained from the Superintendent of Documents at 10c a copy.

Comparatively few users of this material are really familiar with it. Even among architects and builders, oxychloride cement products are often known only in connection with trade names. The rapidly increasing demand for these materials shows that they possess certain desirable peculiarities, and has made it necessary to replace haphazard or "rule of thumb" methods in the manufacture and use of this cement with more scientific methods based on the study of numerous tests.

Caustic magnesia, the chief constituent of oxychloride cement, was made in the experimental cement plant of the Bureau of Standards by calcining magnesite ore. The temperature and other conditions were varied in order to study the effects on the properties of the product. An ore imported from Greece, one shipped from the State of Washington, and two from different mines in California were used, as these were representative of the chief sources of supply for this country. Cement mixtures, typical of those used by the trade, were then made, and tested both in the laboratory and on panels of flooring and stucco exposed to actual service conditions.

The results of this work form an important contribution to the information necessary for the production of the most satisfactory oxychloride cement products.

Improved Apparatus for Testing Bricks

An improved apparatus for the transverse testing of brick has been designed by H. L. Whittemore of the Bureau of Standards. During the past month 500 brick were tested to determine whether this apparatus was superior to that specified by the American Society for Testing Materials. 250 brick were tested in each apparatus. The

bricks were of 3 different kinds, 200 being clay brick, 200 cement, and 100 sand-lime brick. The average results were practically the same for both types of testing fixtures but with the Whittemore apparatus it was possible to test 100 brick in 3 hours, while $5^1/_4$ hours were required to test the same number with the A. S. T. M. fixtures. With the latter apparatus, 5 pieces are displaced when a brick is broken, and these must be accurately replaced in position for the next test. There are no displaced parts when a brick is broken in the new holder. Since both devices give equal results for the modulus of rupture of a brick, and since the A. S. T. M. fixture requires more time, the new apparatus is evidently an advance in the field of testing equipment.

Development Test for Hardness of Glazes and Investigation to Increase the Hardness of These Glazes

The Ceramic Division of the Bureau of Standards is developing a hardness test for porcelain glazes which consists essentially in wearing away the glaze by means of a standard sand which is allowed to run through an orifice of known dimensions and to strike upon the inclined surface of the specimen after falling a predetermined distance. Satisfactory results are being obtained in comparatively short intervals of time and with small amounts of sand, both being well within practical limitations. A circular letter has been sent to a considerable number of potters asking that samples be submitted for testing.

Meeting of Advisory Board on Dictionary of Specifications

A meeting was held on October 24th of the Board organized to act in an advisory capacity to the Department of Commerce in compiling material for and publishing a handbook of specifications for commodities purchased by federal, state and municipal governments and public institutions. As was mentioned in last month's *Bulletin*, there are more than 20,000 commodities which can properly be classed as articles purchased out of taxes for which there should be specifications, whereas there are now in existence less than 5000 specifications for such commodities.

At the meeting of the Advisory Board, at which there were present representatives from all but one of the organizations represented on the Board, unanimous approval was voted for the proposed plan for issuing shortly in convenient form a thoroughly classified list of all known existing commodity specifications.

The Board voted unanimously for the creation by the Secretary of Commerce, as Chairman of the Board, of three committees from its membership to render reports for the approval of the Board on the subjects of (1) classification of commodity specifications; (2) form and size of the publication; and (3) scope of the proposed handbook or encyclopedia of specifications.

It was the unanimous opinion of the Board that future meetings should be subject to the call of the chair.

CALENDAR OF CONVENTIONS[1]

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 4–9, 1924	Atlantic City
American Concrete Institute	Feb. 25–28, 1924	Chicago

[1] Further information may be secured through the Chamber of Commerce of U. S., Washington, and World's Convention Dates, New York, N. Y.

American Institute of Electrical Engineers	Feb. 4–7, 1924	Philadelphia
American Malleable Castings Assn.	Jan., 1924	Cleveland, Ohio(?)
American Road Builder's Assn.	Jan. 14–18, 1924	Chicago
American Zinc Institute	May, 1924	St. Louis, Mo.
Assn. of Scientific Apparatus Makers of U. S. A.	April 18, 1924	Washington, D. C.
Common Brick Mfrs. Assn. of America	Feb. 11, 1924	Los Angeles, Calif.
Gas Products Assn.	Jan., 1924	Chicago
Hollow Bldg. Tile Assn.	Jan., 1924	Chicago(?)
Institute of Metals, Div. of American Institute of Mining and Metallurgical Engineers	Feb., 1924	New York City
Natl. Assn. of Stove Mfrs.	May 7–8, 1924	New York, Hotel Astor
Natl. Bottle Mfrs. Assn.	April 27, 1924	Atlantic City
Natl. Brick Mfrs. Assn.	Jan. 28–Feb. 2, 1924	Cincinnati, Ohio
Natl. Builders Supply Assn., Inc.	Feb., 1924	Chicago(?)
Natl. Electric Light Assn.	May or June, 1924	
Penna. Gas Assn.	April, 1924	Atlantic City
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	April or May, 1924	(?)
Western Society of Engineers	June 4, 1924	Chicago

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings
of the Society, Discussions of Plant Problems, Discussions
of Technical and Scientific Questions and
Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

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H. F. Staley, R. R. Danielson — Enamel
A. R. Payne, A. E. Williams — Glass
E. E. Ayars, R. F. Ferguson — Refractories
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R. B. Keplinger, A. P. Potts — Heavy Clay Products

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EDITORIAL

THE 1924 ANNUAL CONVENTION

The Annual Convention of the American Ceramic Society is an occasion of paper readings but of more importance is it as an occasion for exchanging information on problems of common concern, and for making personal contacts by which coöperation can be had throughout the year in the solving of problems and the obtaining of information. No man has ever with profit lived for and by himself. Mutual dependency on fellow beings has always been and is increasing. We are profiting from things already accomplished and recorded, but the facts being made known today in both fundamental and applied science are so surpassing in amount and in diversity that a year now is as decades past in the revealings of facts essential to economical manufacturing. Collaboration is now far more necessary. The opportunity and time to find the fundamentals, and the capacity to apply them in the devising of ways and means of manufacturing is beyond the possibilities of individuals working alone. These require the collaboration of many. It is in the establishing and maintaining of personal and organized group contacts through which this essential collaboration is possible that conventions have their greatest justification.

The impression is had by some that the larger number of the papers listed on the programs of the convention of this Society are from Univer-

sities, Bureaus and Institutions of research and from those who supply materials and equipment. This is not and has not been the case. For the 1924 Convention 62.4% of the 169 papers and addresses are from the industrial laboratories and factory operators; 8% of these 62% are trade association releases. Only 14.3% of the papers are from Universities and 23.2% from the public and semi-public laboratories.

It is this 62.4% of papers from the industrial workers that reveals the purpose of these annual conventions and the benefits which accrue to the industrialists who attend. It is a logical conclusion that if this holding of conventions for the past 26 years had not profited manufacturers, the number of delegates attending each year would have decreased rather than increased and the percentage of contributions from the factories would not have continued to be in the majority.

If the SOCIETY served in no other wise than as a means of collaborating in the finding and classifying of records of fact findings, and in making application of these to manufacturing it would be worth while. It is and must continue to be more than this. It must be the medium for personal contacts and social relations of men engaged in like pursuits. Our pace in things mechanical is so swift that real effort must be made to keep the human relations apace. We can now "tune in" for a conversation across the ocean. We are today closer to humans on the other side of the world than were the peoples in a given State a few years ago. Canned music or music vibrating direct from strings thousands of miles away are no longer dreams; they are realities for all who will but "tune in." So it is in all human endeavors, industrial as well. We must "tune in," must have the essential equipment and adjustment.

So far there has been no substitute found for the printed record and for the convening together for collaboration as means of securing this essential equipment and adjustment. No one can afford to isolate himself. He must read. He must convene with others.

PAPERS AND DISCUSSIONS

THE PULSICHROMETER

By Francis A. H. Schepers

The discussions on pulsichrome published in this *Journal*[1] were rather brief. The writer has since had occasion to study the advantages of this machine very carefully. Let us first confine ourselves to the laboratory and shipping department of the terra cotta plant. Our first experience was on a rather large job, approximately 1800 tons of terra cotta. A certain amount of samples were run and after the architect's approval was obtained, we immediately set to work. To date we have finished 500 tons of this job and it is gratifying indeed that there was need of reslipping only one piece. The results were 100% perfect as far as the slipping is concerned.

Motor trouble is unknown to us. These machines have run day after day and week after week without the slightest indication of trouble.

Occasionally the men may have to stop for a few minutes to clean their machines, due to some dirt or grit getting in, which, of course, can be entirely overcome by careful screening of the enamels. This "clogging up" can occur with any ordinary slipping machine if the necessary care is not exercised.

Aside from the good results obtained in the slipping room it reduced the cost of manufacture considerably in this department. Where heretofore it required from four to five men to glaze enough terra cotta in two days to fill a fifty-ton kiln, from two to three men can turn out just as much and better work in the same length of time and consequently reduce the cost of labor approximately 50%.

The same saving applies to the glazes, where, with the old method it required about a barrel of glaze to cover from six to eight tons of terra cotta, this same amount is sufficient for about fifteen tons of pulsichrome terra cotta. These are actual usage figures. Quite a few pieces have been examined very thoroughly under the microscope and although the appearance of the glaze is rather thin, the entire surface is well covered.

The work in general is much simpler. We all have tried at some time or other to "imitate" granites with the old method. In most cases it required four men to apply the different colors and what was the result? Generally a loss of time and money and the material produced looked "something like" granite. After careful study and a lot of switching around of the various pieces in the fitting room to secure a fairly good take up in color (thereby depending largely upon the artistic eye of the fitter

[1] E. Clark, "The Use of Pulsichrome from a Manufacturer's Standpoint," *Jour. Amer. Ceram. Soc.*, **5** [11], 826(1922); L. M. Munshaw, "The Pulsichrometer *vs.* An Old Method of Applying Glazes," *ibid.*

boss) we were satisfied it would pass as "granite." This has been a common occurrence in many plants and we all can see the results daily at the buildings.

The laboratory also benefits a great deal with the use of pulsichrome as the amount of colors used is greatly reduced in number. Large batches of enamels and slips are made up and after the correct specific gravity is obtained, all there is required is a little intelligence on the part of the workman who handles the machine.

Another nice feature is the ease with which certain color combinations are reproduced after a certain length of time, especially in a case of "remakes." It is unnecessary to run all over the yard and find an old overpiece of a certain job or perhaps try to find the man who made it years ago and try to duplicate it, trusting to luck that it will look somewhat like the original job. All we need in this case is the correct specific gravity of the colors, plate number and air pressure and the pulsichrometer will do the rest.

Another fact deserves mention. While heretofore quite often objections were raised by the men in the slipping room about the dust "flying" around with the old method of spraying, we have now a machine which eliminates this nuisance entirely.

Finally we come to the artistic value of the pulsichrometer. How tiresome it is to look at those plain white or cream surfaces on the buildings we all know. They may be practical, but the pulsichrometer will combine beauty with this feature.

Some time ago the writer drove by Terra Cotta Avenue in Chicago (sometimes called Midway) and had an opportunity to observe the various color schemes in the buildings. The most wonderful results have been obtained, and many fine examples of pulsichrome are to be seen. Pulsichrome is in its infancy. Beautiful things have been created in the course of a few years and let us ask the question now; what are we going to see in the next ten years? This answer is solely up to the terra cotta manufacturer. We cannot afford to let everybody have his way about it, for if we do pulsichrome will be discarded in a very short time. The success of it lies in the coöperation of the architect with the plant chemist. If the practical chemist, with his broad knowledge of colors and color combinations can foresee freaky results, it is his duty to caution the architect and only put those combinations on the market which are a credit to pulsichrome. The experienced plant chemist holds the future of the pulsichrometer, on his good judgment and artistic feelings depends the production of material of value.

Let us be conservative with the selecting of colors and entrust the machine only to those who are capable of handling it. We can put a box of paint and brushes into the hands of a child, but will this child produce

anything of value? The same with the pulsichrometer. The people will have to be shown what can be produced by the intelligent selection of colors, the experienced man must in his turn instruct the novice to use only such colors that will give perfect harmony and express the beauty of terra cotta.

Pulsichrome is also an important factor in combination with polychrome. We are well aware of the deplorable results that can be seen in polychrome. Pulsichrome eliminates this completely. Once a certain combination of colors is decided upon, each one of these colors can be used separately for decorating certain fields and the result is that pulsichrome combined with polychrome is in harmony, it is bound to produce a pleasing effect, something soothing to the eye without having to wear smoked glasses in order to be able to stand the strain in looking at them.

The pulsichrometer is a source of untold mysteries. Sometimes we are trying to get a certain color effect, and how agreeably are we surprised when our experimental work comes from the kilns, and we say to ourselves that we do not remember putting that certain color combination on the samples. How many times do we produce an effect, that we were not looking for at all, something better and more beautiful than we expected? The old method of glazing did not possess the charm and power to blend the different oxides to produce color schemes hitherto unknown.

We have gone a great step forward in making good our statement, that "terra cotta shall look like terra cotta" and not be an imitation of some other material. Pulsichrome has its unique appearance and wherever it is used on a building will immediately characterize the material as the "nec plus ultra" of terra cotta.

The Advance Terra Cotta Co
Chicago Heights, Ill.

ELIMINATION OF WASTE IN THE HEAVY CLAY PRODUCTS INDUSTRY

By Marion W. Blair

Waste in various forms is characteristic of American methods in general. We were horrified by our own reckless extravagance in waging the late war, but we continue year after year to pay an increasing bill of upward of $25,000 per hour for preventable fire loss. We let $30,000 per hour run to waste at Niagara Falls, and continue to pay an annual board bill for rats amounting to more than $200,000,000.

These figures throw into insignificance the petty waste of coal, oil, time and labor existing in the manufacture of heavy clay products. There is this outstanding difference, however. The fire and rat loss is borne collectively by 110,000,000 people, and it is difficult to place individual

responsibility, but the waste sustained by the manufacturer of heavy clay products is borne by the individual responsible for it, or by his close business associates and financial backers.

The waste begins with the establishment of the plant, purchase of its site and raw material supply. Hundreds of acres of needless shale and clay lands or mineral rights are bought, and future years must carry the burden of sleeping capital and extra taxation.

Land that is barren and worthless suddenly takes on a new value as raw material when acquired by a clay working corporation.

One million brick per foot acre of clay is a conservative figure. There is then a possible 25,000,000 or 50,000 per day for two years in an acre of clay 25 feet deep, with 50 years operation in a 25-acre deposit of clay 25 feet deep. It would seem a needless waste of capital to tie it up in land which probably will not be touched for 200 years. Capital at 6% unemployed eats its head off six times in a century.

Complete monopoly of raw material in any given district is an impossible if not an undesirable condition. The inability to make future purchase at a relatively reasonable figure is an unlikely condition, and has not been borne out by past experience. However, cumbersome and useless property with a fictitious value has been an obstacle to the sale of many plants, and has been an important factor in the failure of clayworking enterprises.

Plants have been built to supply a temporary local demand without any chance of marketing a future output at a profit, and the growing necessity of entering new fields develops the fact that the relation of market and location had been entirely overlooked. The waste due to poor location eats into profits year after year, and no amount of ingenuity can make it up. Building without competent engineering service often prolongs the period of eye tooth cutting characteristic of the first year's operation of most new plants—and a standardized product is much slower to attain.

The majority of the going plants, the exception being a dozen or so recently built and properly engineered, are suffering from these handicaps of bad judgment and misapplied capital.

Other wastes, those of operation, due largely to lack of attention to small details, can be very greatly reduced or eliminated, and therein lies a profit not to be despised in spite of higher fuel and labor and almost prohibitive freight rates.

Those plants which have been established some years are suffering wastes as a matter of habit. Things are done thus for no other reason than that they have been done thus in the past. If a question is raised the answer is that so and so is a practical man and has been doing it that way for twenty-five years. But suppose it can be done better or cheaper or both, does twenty-five years of past error or ignorance justify twenty minutes continuation if it is losing money? No matter how much profit there

may be in a particular operation, money is being lost if it is possible to do it cheaper and better. For instance, long time burning has been shown to be unnecessary on plant after plant. The operation has been guessed at for years by the so-called practical man. Pyrometer systems have been fought by him—in some cases thrown in the discard as useless—and the eight and nine day burn continues, involving a waste of time, labor, fuel and capital. Many burns are carried along eight or nine days because of fear of carbon and consequent swelling, and the burner would prefer, through indifference or ignorance, to shovel coal two days rather than arrange proper trials to be drawn to determine when the carbon has disappeared and it is safe to raise the heat.

It is perhaps typical of the industry that some $20,000 has been spent in the last two years to convince itself that time and fuel can be saved on present equipment by knowing at all times how hot the kiln is, and keeping the fires going so as to advance the heat continuously. Yet more than ten years ago six day burns of shale paving block in periodic kilns were not unknown, but an intelligent application of the discovery to the industry has not yet been made. It was thought better to burn 25% excess fuel and play safe than to risk even one kiln in an effort to save that amount.

I once read a story of a business man who walked over a fairly prosperous farm and threw down in cash the value of machinery which was lying about ruined by exposure to weather and careless abuse. Twenty dollars here for a plow, two hundred for a binder, a dollar for a spading fork, to say nothing of scythes hung in trees and crops left to rot on the ground. I have often thought that a reckless banker could find a good day's amusement on the average brick plant sowing silver in the place of half- or never-used equipment—bolts, railroad spikes, wheelbarrows, clay cars, locomotives, pugmills, cutting tables, brick machines, engines, and boilers lying about—the management either too sentimental or worse to turn same into cash either as second hand equipment or scrap.

Covering for steam pipe pays for itself in forty-five days. The job should be complete and include fittings, valves and separators. The plants whose steam lines are not covered are paying for the material eight times a year, and getting nothing for the money.

Engine oil which should go through a thirty-five dollar filter and be reclaimed goes into the ground around the foundation.

Driers are crowded and each attempt to set green ware results in excessive waste, both in bats on the drier cars and number two ware in the kilns. Burned bats are carted to the dump rather than repair a kiln floor. Number 1 brick go out with the No. 2 and No. 2 with the No. 1. Weights are not checked—a die is run as long as it will produce a column. If oversize it wastes material, power, fuel and freight. A small amount per brick runs into hundreds of dollars on a ten million production.

Kilns are allowed to cool according to the weather and seldom on a schedule; the invested capital and production they represent idle and limited.

Repairs are ordered after a breakdown. Not in advance.

One plant in a thousand owns or uses indicators, anemometers, gas analysis outfits or other controlling apparatus. Such operations as could be accurately measured are guessed at, and the result is waste—boiler walls and arches leak, air heat of exhaust steam goes through the roof instead of into feed water.

There are plants where the test for a hot drier is to spit on the fan housing, and kiln fires regulated by kicking a gas valve. Is it any wonder that the past year has seen plant after plant shut down for lack of business at a profitable price, or that there has been almost a square yard of concrete pavement laid for each brick that has been so used?

Criticism without constructive suggestion is worthless, and the natural question after such an arraignment as the foregoing is, "What is the solution?" The answer has not changed a particle in two years, and it will not change in another fifty. It is the employment of trained minds in responsible positions—foremanships and superintendents—men who have been taught to think from cause to effect and back again. The payment of sufficient salaries, and enough of them to hold the technical men in the industry and keep them out of white collars.

St. Louis, Mo.

DISCUSSION ON "SUBSTITUTING OIL FOR PRODUCER GAS"[1]

G. Ross:[2] We are using Mexican fuel oil of 12–13° Baumé, preheated at about 45°C in burners, to heat a furnace of 7 x 1.3 m. section. The depth of this furnace is 2 m. For our purposes the highest regularity and highest division possible of the developed calories is of the biggest importance. To spread the flames and calories regularly on the surface of 7 x 1.3 m. we made many trials with pressure, temperature and gravity of oil.

The temperature we need is about 1450°C. First we began with oil of 16°Bé. But soon we remarked a partial decomposition of the atomized oil, the fumes charged with oil gases brought them to the lower parts of the furnace till to the top of the chimney of 25 m. high.

At the high temperature we need a heavier oil to avoid decomposition, which burns slower and makes it easier to divide the calories throughout the furnace section. The 12°Bé gave us satisfaction. Essaying the pressure for the purpose of spreading the flames as regularly as possible and to arrive at the same time at the highest temperature to be developed

[1] *Bull. Amer. Ceram. Soc.*, **2** [12], 373 (1923).

[2] Metallurgical Engineer. Saltillo, Coah., Mexico.

near the mouth of the burner, we first used 40 pounds. But these pressures gave us the bigger part of the calories $^2/_3$ of the way from burner to the end of the furnace. The combustion of the mixture of oil and air was too late to permit us to arrive at the highest temperature we need. With 10–12 pounds the result was the best for assuring high temperature at about 1 m. distance from the burner and to bring the calories about everywhere in the section.

To bring the calories necessary to the objects placed in the laboratory of the furnace, we are burning with a slight excess of atomized oil. In this way the calories are transmitted the best to the objects to be handled, the carbon particles of the excess fuel oil are necessary for heat transporting and transmission.

The price of Mexican fuel oil we use is about 0.60–0.65 cts. per barrel in the car at Tampico. The ton of oil cif workplant is about 10 dollars. Mexican coal will be about 7 dollars cif. Costs for our purposes are cheaper with oil than with the coal.

ACTIVITIES OF THE SOCIETY

THE ROSTER IS RISING

Thirty-three persons and six corporations joined during the month of December 15 to January 15. A good start is already had for a big record for January. The "saturation point" is not yet in evidence. Who said this could not be a SOCIETY of 3000 persons and 500 corporations? It can and it will as long as each member does his share of coöperating. The net totals to date are 1990 persons and 296 corporations or a grand total of 2286.

The record for the year 1923 by months is as follows:

	Persons	Corporations			
January	110	10	August	17	3
February	29	0	September	15	2
March	37	3	October	68	30
April	37	7	November	29	6
May	32	7	December	31	6
June	20	6			
July	27	5	Total	452	85

The net gains by years have been as follows:

1918	180	33	1921	221	47
1919	231	44	1922	261	77
1920	181	15	1923	379	80
			Total	1453	296

Is there any evidence here of a let-up in the rapid roster rise? Is the SOCIETY nearing the "saturation point?" No.

NEW MEMBERS RECEIVED FROM DECEMBER 15 TO JANUARY 15

PERSONAL

H. Clinton Baldwin, Y. M. C. A., Perth Amboy, N. J., Roessler & Hasslacher Co.

Harold D. Barger, Salesman, Wellsville Fire Brick Co., Wellsville, Mo.

R. F. Benzinger, The Electric Furnace Co., Salem, Ohio, Vice-President and Sales Manager.

H. R. Borland, 206 Barker Ave., Peoria, Ill., Ceramic Engineer, Peoria Brick & Tile Co.

Emil Bronlund, Brule Mines P. O., Alberta, Canada, Superintendent, Blue Diamond Coal Co., Ltd.

William T. Christian, Supt., Wellsville Fire Brick Co., Wellsville, Mo.

Robert L. Clark, 3101 Passyunk Ave., Lab. Asst., U. G. I. Contracting Co., Philadelphia, Pa.

Anthony Di Dio, Glenn Hotel, Richmond, Calif., Chemist, Pacific Sanitary Mfg. Co., Vitreous Plant.

Morgan B. Eilert, Red Bank, N. J., Supt., The C. Pardee Works, Perth Amboy, N. J.

Chas. F. Eilert, Red Bank, N. J., Manager-Secretary, The C. Pardee Works, Perth Amboy, N. J.

Roger L. Fellows, 109 N. Ashland Ave., La Grange, Ill., University of Illinois.
Shinzaburo Fuzita, % Mitsui Dyestuff & Chemical Works, Omuta, Japan, Engineer of the Fire Brick Department.
Robert Galbraith, Crystal Lake, Ill., Lab. Asst., American Terra Cotta & Ceramic Co.
Gustave Glocker, North East Porcelain Co., North East, Md.
E. Carlile Gravatt, 59 N. Pearl St., Bridgeton, N. J., Illinois Glass Co.
Earl B. Hagar, Asst. Supt., Wellsville Fire Brick Co., Wellsville, Mo.
W. D. Harvey, Monarch Engineering Mfg. Co., 1206 American Bldg., Baltimore, Md.
Earl L. Hauman, Hillview Place, Hamburg, N. Y., Engineer, Electro-Refractories Corp., Buffalo, N. Y.
Raymond A. Heindl, 4917 43rd St., N. W., Washington, D. C., Asst. Chemical Engineer, Ceramic Division, U. S. Bureau of Standards.
C. Walter Kelly, Jr., 3756 Hancock Ave., W., Detroit, Mich., Sales Manager, Face & Fire Brick Division, United Fuel & Supply Co.
Edward R. Ketchem, 242 North E St., Hamilton, Ohio, Enameling Plant, Estate Stove Co.
H. G. Kiger, Manager, Wellsville Fire Brick Co., Wellsville, Mo.
William C. Loudon, 2635 Norman Ave., Detroit, Mich., Head Mason Inspector, Detroit City Gas Co.
Leroy Marx, % The Denver Terra Cotta Co., Box 1860, Denver, Colo., Ceramist.
Daniel J. McSwiney, 1819 Maple St., Alton, Ill., Consulting Chemist.
George Z. McClelland, Gladding-McBean & Co., Lincoln, Calif.
Harold V. E. M. Renn, Sowerby's Ellison Glass Works, Glass Technologist, Gateshead-on-Tyne, England.
William Reynolds, Asst. Supt., Scranton Enameling Co., Scranton, Pa.
Murray Sinclair, West Morris St., Bath, N. Y., H. P. Sinclair & Co.
George Sirovy, 1486 Perry St., Des Plaines, Ill., Enameler.
Evelyn Tennyson, Alfred University, Alfred, N. Y. (Student Member).

CORPORATION

Buckwalter Stove Co., Royersford, Pa., Joseph A. Buckwalter, Treasurer.
Cleveland Metal Products Co., Cleveland, Ohio, C. A. Blackburn, Superintendent.
Grand Rapids Refrigerator Co., Grand Rapids, Mich., Charles H. Leonard, President.
Mansfield Vitreous Enameling Co., Mansfield, Ohio, P. A. Adams.
Scranton Enameling Co., New York & Jefferson Aves., Scranton, Pa.
Wolverine Porcelain Enameling Co., 3350 Scotten Ave., Detroit, Mich.

PERSONAL NOTES OF MEMBERS

A. R. Anderson of the Kentucky-American Clay Co., requests that his address be changed to Pineville, Ky.

Robert E. Armstrong, salesman for Harbison-Walker Refractories Co., has moved to 712 E. 50th St., Indianapolis, Ind.

Edwin P. Arthur, formerly of Columbus, Ohio, is at Morgantown, W. Va., 701 Willey St.

Edgar Boblett, formerly of Nappanee, Ind., is located at Culver, Ind.

B. M. Burchfiel has completed his work with the Los Angeles Pressed Brick Co., and is now connected with the Pacific Clay Products Co., Inc., 306 West Avenue 26, Los Angeles, Calif.

H. T. Bush is at Inglebush, Porte Hope, Ontario, Canada.

Rod. Castro Oliveira gives as his permanent address Casilla 4049 Santiago, Chili, S. A.

Max D. Compton is now living at 4254 Moneta Ave., Los Angeles, Calif.

Karl Ford, of the Bureau of Standards, Washington, D. C., has moved from Silver Springs, Md., to 1333 30th St., N. W., Washington, D. C.

Major E. Gates, who has been located at 138 N. LaSalle St., Chicago, Ill., has moved his office to 128 N. Wells St.

Clarence A. Hall, has moved from Cresheim Arms, Allen Lane, Mt. Airy, to 7951 Winston Road, Chestnut Hill, Philadelphia, Pa.

Mitsu Kato, who has been listed among "Unknown Addresses," gives Mitsuishi-cho, Okayamaken, Japan, as his address.

Walter T. Lippert gives as a new address 123 Fayette St., Bridgeton, N. J.

Crawford Madeira has moved from 900 North American Bldg., to the Atlantic Bldg., Philadelphia, Pa.

Jefferson Middleton gives as his address 3401 16th St., N. W., Apt. 23, Washington, D. C.

Frank E. Owen, formerly of Findlay, Ohio, is now with the General Porcelain Co., Parkersburg, W. Va.

F. W. Owens requests that his mail be sent to the National Enameling & Stamping Co., 1901 Light St., Baltimore, Md.

George W. Parker is located at 603 Laclede Gas Bldg., St. Louis, Mo.

R. J. Riley has notified the Secretary's office that he has moved from Brightwood, Ind., to Terra Cotta, Ill.

T. D. Tefft is now located at Darlington, Pa.

Erwin F. Theobald requests that communications be sent to him at 1413 13th St., N. W., Canton, Ohio.

Boris Trifonoff has moved from Muncie, Ind., to 1210 Elm St., Zanesville, Ohio.

Ray T. Watkins is now living at 503 S. Race St., Urbana, Ill.

Robert C. Zehm, formerly with the Bureau of Mines, is now employed with the Los Angeles Pressed Brick Co., Los Angeles, Calif.

MEMBERSHIP WORKERS' RECORD

	Personal		Personal	Corporation
Charles F. Binns	1	Percival Marson	1	
B. F. Carter	1	L. M. Munshaw	1	
R. R. Danielson	1	Andrew N. Outzen	1	
Geo. P. Fackt	1	Carl Perg	1	
R. F. Geller	1	W. A. Potter	1	
V. A. Giesey	1	Hachiro Saito	1	
Roland J. Gouin	1	George Simcoe	1	
R. K. Hursh	1	Donald E. Sharp	1	
I. A. Krusen	4	Karl Turk	1	4
Paul G. Larkin	1	Otto W. Will	1	
Walter T. Lippert	1	Office	6	2
M. E. Manson	1		—	—
		Total	31	6

ADDRESSES UNKNOWN

Members of the AMERICAN CERAMIC SOCIETY are urgently requested to forward the correct addresses of the following persons whose *Journals* have been returned to the office of the Secretary as a result of an insufficient or incorrect address. The address given below with the name is the last one which appeared on the official file of the SOCIETY.

Fred J. A. Arbenz, Florentine Pottery Co., Cambridge, Ohio.
G. L. Austin, Joliet, Ill.
G. V. Baker, Penn Feldspar Co., Barnard, N. Y.
Earl A. Bickel, Postville Clay Products Co., Postville, Iowa.
Fred H. Butterfield, 4906 McPherson Ave., St. Louis, Mo., Crunden Martin Mfg. Co.
A. Marietta Byrnes, 63 Anderson Place, New Orleans, La.
J. P. Callaghan, % Teaque Hotel, Montgomery, Ala.
C. V. Cameron, Whiting-Mead Commercial Co., 2035 E. Vernon Ave., Los Angeles, Calif.
Homer T. Darlington, Box 736, Natrona, Pa.
S. E. Davis, 1117 Murdock Ave., Parkersburg, W. Va.
Charles S. Dolley, Keramoid Mfg. Co., Fort Madison, Iowa.
L. E. Ells, 4255a Flad Ave., St. Louis, Mo., Laclede-Christy Clay Products Co.
Koji Fujioka, Shofu Porcelain Mfg. Co., Kyoto, Japan.
M. S. Gifford, Lake Bluff, Ill.
William Gardner, Gardner Feldspar Co., Hartington, Ontario, Canada.
A. H. Goodman, Box 915, Pittsburgh, Pa.
George M. Grady, 74 Pacemont Rd., Columbus, Ohio.
John L. Greenwood, Lehigh Sewer Pipe & Tile Co., Lehigh, Iowa.
Park Hitchins, 1447 Oliver Bldg., Pittsburgh, Pa.
Sidney H. Ivery, 4432 Gibson Ave., St. Louis, Mo.
William J. Johnson, 4148 Langland St., Cincinnati, Ohio.
Y. Kitamura, Shofu Kogo Kafushiki Kaisha, Kyoto, Japan.
E. W. Koering, Crystal Ave., Vineland, N. J.
Charles E. Kraus, 110 W. 40th St., New York, N. Y.
George J. Lawrence, J. B. Ford Co., Wyandotte, Mich.
Arthur T. Leahy, 5490 Ellis Ave., Chicago, Ill.
William H. Marr, % Canadian Libbey-Owens Sheet Glass Co., Hamilton, Ont., Canada.
J. J. Miller, % Nesbit & Bollen, 403 Liberty Ave., Pittsburgh, Pa.
Leon W. Mitchell, Rock Island, Ill., Rock Island Stove Co.
W. O. Mitscherling, % Atlas Powder Co., Wilmington, Del.
Knud Y. Chr. Moller, 4956 McPherson Ave., St. Louis, Mo.
F. H. Nies, Cor. Hamilton Ave. & Summit St., Brooklyn, N. Y.
K. Okura, 84 Kobayashi-Cho, Nagoya, Japan.
J. Clair Peck, 4961 Neosho St., St. Louis, Mo.
W. Pendrup, Coonley Mfg. Co., Cicero, Ill.
Frank J. Pohs, 1097 Interstate Ave., Portland, Ore.
E. K. Proodian, Newtown, Bucks Co., Pa.
H. M. Pulsifer, Manhattan Bldg., Chicago, Ill.
Paul Q. Quay, Lake Shore Blvd., Euclid, Ohio.
G. W. Rathjens, 6100 Dorchester Ave., Chicago, Ill.
W. H. Reid, 10 Stanley Pl., Yonkers, N. Y.
Cedric L. Rennieburgh, A. C. Spark Plug Co., Flint, Mich.
J. E. Thompson, 2507 Townsend Ave., Detroit, Mich.

John F. R. Villalta, Apartado No. 65, Barcelona, Spain.
William J. Vodick, 1733 Lake Ave., Wilmette, Ill., Chicago Hardware Foundry Co.
Frank A. Weidman, 38 S. Dearborn St., Chicago, Ill., Inland Steel Co.
E. J. Winkleman, Box 1122, Pittsburgh, Pa.
Miles M. Zoller, 208 S. LaSalle St., Chicago, Ill.

PITTSBURGH SECTION MEETING

The annual business meeting and election of officers for the Pittsburgh Local Section of the Society was announced for the evening of January 22, 1924. Following a dinner served at the University of Pittsburgh Cafeteria, the meeting was to take place at Mellon Institute. A four-reel motion picture, "The Story of Refractories," was to be shown prepared by the U. S. Bureau of Mines and Laclede-Christy Company.[1]

DETROIT SECTION MEETING[1]

The Time: January 22nd Dinner at 6:30 P.M.
Lecture at 8:00 P.M.
The Place: Elk's Club
The Speaker: A. V. Bleininger (internationally known authority on refractories).
The Subject: "The Properties of Refractories from a Physical and Chemical Standpoint."

This talk will be presented in a clear concise form which anyone can understand, and will follow up Mr. Bleininger's first talk on "Specifications for Refractories." This will be followed later by a third talk entitled, "Specifications for Refractories Used in the Metallurgical Industries." At a fourth meeting a five-reel motion picture showing in detail the manufacture and applications of refractories to the industries will be presented.

CHICAGO LOCAL SECTION

Election of officers of the Chicago Section of the American Ceramic Society was held in Chicago, December 15, 1923, at the Morrison Hotel. The officers for the new year are:

President: H. C. Beasley, Supt., Coonley Mfg. Co., Chicago.
Vice-President: William Knowles, Titanium Alloys Co., Chicago.
Secretary-Treasurer: R. A. Rahn, Leveltown Potteries, Chicago.
Councilor: C. W. Parmelee, Ceramics Dept., University of Illinois.
Papers were read by L. H. Menne and W. A. Hull.

WANTED: AN ANALYTICAL SECTION

By H. H. Stephenson

On coming to this country one received many impressions of which the first was pleasure at the high quality of the ware produced, and the second a mild surprise at the scarcity of works laboratories and the very moderate salaries paid to chemists.

[1] Received in Secretary's office, January 15, 1924.

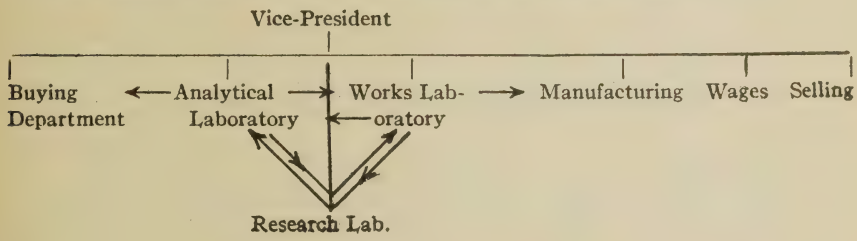
The legend in Europe is that American research has infinite financial resources behind it.

It is of my third and fourth impressions that I wish to speak, and these concern (*a*) purchase of raw materials, (*b*) loss in manufacture.

The answer to both lies in the analytical laboratory.

Raw Materials.—The very first analysis I did in this country of an important, ingredient delivered in bulk at a plant showed that the material was hopelessly inferior, and we obtained a letter of "explanation" from the sellers. In England there would have been a law case with some hundred dollars for a few minutes chemical evidence on the stand. But nothing happened. The manufacturer seemed to think it natural to pay a good price for a 40% adulterated article.

The following scheme shows the rightful position of the chemists:—



The purchase of a raw material should be conducted on rigid lines: Vice-President initials list of sellers. Buying department asks for quotations and samples. Chemist analyzes them and reports on the purity, on the presence of harmful impurities, and on the price calculated to 100% purity. Vice-President decides, and a specification is made out to govern the bulk delivery according to sample. Immediately the consignment has reached the plant, and before the sale is completed, the chemist makes a representative sample and analyzes it. If not up to the original, the consignment is returned at seller's expense.

I take "yellow oxide" of uranium (sodium uranate), though any example on a large scale would do as well.

Sample A at $3 a pound, Sample B at $4, Sample C at $5.

A contains 45.27% $Na_2U_2O_7$
B contains 70.84%
C contains 93.96%

The remainder in all cases being sodium carbonate with less than one per cent of non-harmful impurities.

At 100% $Na_2U_2O_7$, A costs $6.62, B costs $5.64, and C $5.32 is cheapest and is ordered. Bulk deliveries were 90.22 and 90.92% $Na_2U_2O_7$. C is satisfactory.

This is the only method by which a manufacturer can get 100% efficiency in his purchasing department, and it excludes graft. The reader is doubtless aware that in England there is a law against an employee of one firm taking a commission from another firm. A conviction under that law would hardly be possible without the assistance of the analytical chemists.

Loss in manufacture in this country is certainly twice the loss in European plants, though most firms are in the happy position of being able to ignore it. I have heard it said that the American workman, unlike the American middle class and unlike any class in the old country, puts his wages before his work, but even if that were true it would not be true when a family heritage of the potter's craft has had time to get es-

tablished. Nor can it be attributed to methods of burning. The American kiln is as efficient as the European.

Thus we come back to the variation of raw materials. A hundred ton lot of feldspar should have exactly the same composition in every bag and in every part of every bag.

The facts are, therefore, that an analytical laboratory can halve the loss in manufacture, and take anything from ten to 40% off the cost of raw materials. What is on the debit side? The equipment of a laboratory, $500, and the salary of a chemist, $3000.

An analytical section is wanted to put this across to the manufacturers, to standardize the construction of ceramic laboratories, to coördinate the activities of committees and societies on specifications, and to strengthen the legitimate position of the analytical chemist.

SUMMER MEETING OF THE SOCIETY

Interesting trip to Pacific Coast, July 21–Aug. 16

Following out their plan of "seeing America First" the members of the American Ceramic Society will leave Chicago on the evening of July 21, 1924 for a four weeks' trip to the Pacific Coast. From Spokane, Wash. and Puget Sound on the north to the southern part of California, members will have the opportunity of seeing both the development and enthusiasm of the western ceramic industries and also one of the most beautiful sections of the country. A more satisfying trip for the Society has never been given and never before have the plans been laid so carefully and matured so early as for this inviting trip.

With Chicago as the central starting point, members will gather from the eastern and central states and leave on a private train for Spokane, Washington.[1] The committees of the Pacific Northwest, San Francisco and Los Angeles are already announced and have completed many plans for the comfort and entertainment of the visitors.

In Washington stopovers and visits will be made at Spokane, Freeman, Mica, and Seattle and Auburn. Sight-seeing trips will be made to Mt. Rainier and on Puget Sound. California stopovers will include, Lincoln, San Francisco, Merced, El Portal, Yosemite Valley and Los Angeles and vicinity.

The return trip will be made by any of the transcontinental routes selected by the members and no effort will be made to return to Chicago as a party. A stopover may be made at Grand Canyon if desired.

Summer tourist rates have been secured making the approximate railroad fare including side trips $200.00. This does not include food or hotel expenses.

Early reservations must be made to the Secretary's office, Lord Hall, O. S. U., Columbus, Ohio. These must be in the office on or before June 1.

The Local Committees announced for the western states are as follows:

F. B. Ortman, Tropico Potteries, Glendale, Cal., *General Chairman.*

Pacific Northwest: Hewitt Wilson, University of Washington; Samuel Geijsbeek, Geijsbeek Engineering Co., Seattle, Wash.; Paul S. Mac Michael, Northern Clay Co., Auburn, Wash. (Members to be named.)

Los Angeles: Findlay Drummond, Alberhill Coal and Clay Company, *Chairman.* (Members to be named.)

[1] A private train will be secured if 125 members sign up for the trip. Otherwise private coaches will be secured.

San Francisco: A. L. Gladding, Gladding, McBean and Co., *Chairman;* J. T. Roberts, Stockton Fire Brick Company; N. A. Dickey, Livermore Fire Brick Company; Otto Rosenstein or Kenneth M. Henry, Illinois-Pacific Glass Company; W. Newton Stearns or W. A. Potter, Pacific Porcelain Ware Company.

OBITUARIES

Lemon Parker

Lemon Parker, 67 years old, president of the Parker-Russell Mining and Manufacturing Co., 3314 Morganford road, died of heart disease today at his home, 3413 Oak Hill Avenue, St. Louis, Mo. He had been ill two years and had not been active in business for some time.

Mr. Parker was an active member of the SOCIETY since 1904, and an ever loyal supporter of the SOCIETY. He will be remembered as the originator of the load test at high temperatures. His early experiments are described in Volume 7, p. 185 of the *Transactions* of this SOCIETY published in 1904.

Oscar B. Scherer

Word has been received of the recent death of Oscar B. Scherer, of 5 N. Karlov Ave., Chicago, Ill. Mr. Scherer has been a member of this SOCIETY for a number of years and was known among the enamel manufacturers.

NOTES AND NEWS

MEETINGS OF POTTERY SUPERINTENDENTS AND FOREMEN IN EAST LIVERPOOL, OHIO

There have been held two meetings of the newly formed association of pottery executives. The first meeting has already been reported.[1] The second one held, December 14th, in the rooms of the Potters' Association was a still more pronounced success, there being present about 80 men. At this meeting a number of the working rules governing the relation between the manufacturers and the operative potters were discussed in detail. The desire was expressed that more uniform practices be adopted in dealing with the men. Several problems submitted in the question box which has been made a feature of all programs were given lengthy consideration. With the development of the field of activity of this organization it is certain that future meetings will be crowded with pressing questions. One of the most desirable and pleasing features is the opportunity thus afforded the men from the different plants to become acquainted in the pleasant surroundings of the club. Through the courtesy of the U. S. Bureau of Mines a film was shown which gave the story of refractories as illustrated by the operations of the Laclede-Christy Clay Products Co.

WORK OF THE RESEARCH COMMITTEE OF THE U. S. POTTERS' ASSOCIATION

During the past year the Association has maintained a fellow at the Bureau of Standards, Washington, D. C., who has nearly completed his work. The investigation deals with the study of facts relating to crazing, with particular reference to the thermal

[1] *Bull. Amer. Ceram. Soc.*, **2** [12], 397 (1923).

expansion of the body and glazes, the effect of heat treatment, thickness of the glaze, mechanical strength of body and glaze and effect of the firing upon the microstructure of the body. Already some facts have been accumulated which show that the usual conceptions as to the relation between body and glaze are in error. The work will be completed as soon as possible which should be within the next two months and reported to the Association.

Besides this work the committee has reported upon several subjects, such as sagger preparation, refractories, crazing and the strength of sagger mixes in the dried and fired state. At the present time the activities of the organization are confined to the research mentioned above, at the Bureau of Standards, the study of the sagger question and an investigation of the Texas kaolin. The last-named topic has come up for consideration because of the report that large deposits of this material are actually available at the present time, reports which seem to be substantiated. It is expected that twelve potteries will take part in the work of testing out the Texas clay in a practical way.

CLAY PRODUCTS COURSE ADDED AT STATE COLLEGE

For the first time in Pennsylvania history, young men of the state desiring to make the clay working industries their life profession, will now be able to secure a higher education in ceramic engineering without finding it necessary to go to another state. President John M. Thomas today announced the appointment of J. B. Shaw as head of the newly created department of ceramic engineering at the Pennsylvania State College.

Pennsylvania stands second of all states in the value of its yearly output of clay products, including brick, tile, terra cotta and fine clay pottery, totaling over $31,000,000. There are almost 1000 separate clay working industries in the state employing over 12,000 wage earners. Ceramic engineers have been drawn by these industries from colleges in New Jersey, New York and Ohio, but within the next few weeks young Pennsylvanians anxious to train for this important field will be able to enroll as ceramic students in a four year training course in the Penn State School of Mines, where the second semester starts on January 28.

J. B. Shaw

For many years State College has had demands for ceramic engineers. The new department was authorized by trustees several months ago, and after a long search Professor Shaw was secured as the proper man to take charge. He has been professor of ceramics at the New York State College of Ceramics, at Alfred, N. Y., for eight years. He was graduated as a clay products, or ceramic engineer, at Ohio State University, and has had fifteen years of experience in that field.

The location of this course at State College is fortunate, for throughout central Pennsylvania there is a wide diversity of clay, glass sand, ganister and other plants within easy reach of the college. The college maintains a well equipped laboratory, and the teaching of the subject in the mining school with its geology department is another special advantage.

REPRINTS FROM ANNUAL TABLES

The Secretary-General of Annual Tables announces that the following list of reprints from Volume IV is available for sale at the prices indicated.

	Pages	Price (Fr. francs) Paper	Bound
"Spectroscopy," by M. L. Brüninghaus. Preface by A. Fowler, F. R. S.	210	35	45
"Electricity, Magnetism, Conductivity of Electrolytes, Electromotive Forces," by MM. Malapert, v. Weisse, R. E. Slade and G. L. Higgen. Preface by F. B. Jewett	144	30	40
"Radioactivity, Electronics, Ionization of Gases," etc. by MM. J. Saphores and F. Bourion. Preface by by Sir E. Rutherford, F. R. S.	19	10	18
"Crystallography and Mineralogy," by L. J. Spencer. Preface by Sir Henry A. Miers, F. R. S.	65	15	25
"Biology," by E. Terroine and H. Colin. Preface by Jacques Loeb	37	12	20
"Engineering and Metallurgy," by L. Descroix. Preface by G. K. Burgess	154	30	40
"Colloids," by E. Rebière. Preface by Jacques Duclaux	9	6	12

These reprints contain all of the data for the subjects indicated which are found in Volume IV of Annual Tables, which volume covers the literature of the world for the years 1913 to 1916, inclusive. Specialists having occasion to refer frequently to data in the fields covered by any of these reprints will find them invaluable for ready reference, and at the present rate of exchange the cost of these reprints is very small.

Members of any of the organizations listed below are entitled to a 50% discount on the prices given above.

Orders for any of these reprints should be sent direct to Dr. Charles Marie, 9 Rue de Bagneux, Paris 6, and should be accompanied by an international money order or a draft on Paris covering the price of the reprint plus two francs for postage and packing on each order.

National Academy of Sciences
Philosophical Society of Washington
American Philosophical Society
American Academy of Arts and Sciences
American Association for the Advancement of Science
American Institute of Chemical Engineers
American Institute of Electrical Engineers
American Electrochemical Society
American Chemical Society
American Ceramic Society
American Society of Civil Engineers
American Society of Mechanical Engineers
American Society for Testing Materials
American Institute of Mining and Metallurgical Engineers

EXPERIMENTAL DATA LOST

Shinzo Satoh, of the Toyko Electric Company, Kawasaki, Japan and a member of this SOCIETY has written to friends of his loss in the recent earthquake. Mr. Satoh narrowly escaped death when his laboratory collapsed and he was badly injured. All of the data which he had gathered through several years of experiments and studies were lost.

PROPOSED INVESTIGATIONS IN HEAT TRANSMISSION

Division of Engineering, National Research Council: Objects

1. To provide designing, operating, and research engineers with reliable information on heat transmission in as simple and convenient shape as is compatible with accuracy.

2. To analyze theoretical and experimental data already published or otherwise available so as to get them into usable form.

3. To induce the general adoption of a standardized heat transmission research objective to the end that all new research will be conducted in such a way that it will yield generally valuable information.

It is proposed that a suitable committee be organized under the auspices of the National Research Council and the work divided among six sub-committees, namely, publicity; bibliography; theory, nomenclature and definitions; temperature measurements; heat transmission of insulating and building materials, and heat transmission between fluids and solids.

The first work proposed is the critical review of material already published which could be considered in the light of an audit. It is proposed that each article be properly classified, and the material in it abstracted and rearranged in accordance with an approved outline. Critical comments bringing out conclusions in addition to or at variance with the authors will be kept in mind. It is proposed that the full time services of a competent engineer be engaged in this work under the direction of the committee.

Need for Investigations

Heat transmission is in an unsatisfactory state. There is the greatest need for quantitative information that can safely be generalized, for coördination of present knowledge, and for coördination of future work. The nature of this work is executive, editorial and advisory. The establishment of a research laboratory is not contemplated and full use will be made of all present research facilities. The aim is to make present knowledge available in its most usable form, to direct attention to specific items wherein present knowledge fails us, to indicate how future investigations may rectify these faults, and, finally, through publicity, to encourage heat transmission research in accordance with the standards set by the proposed committee on Heat Transmission.

BUREAU OF STANDARDS NOTES

Factors Affecting the Resistance of Tank Block to Glass Attack

Probably one of the most annoying sources of trouble to manufacturers of commercial glass on a large scale is the lining of the glass melting tanks. Very frequently these linings fail through corrosion after 10 to 14 months' service which results in a considerable loss of time and money. A life of 20 to 24 months for such a lining is not considered an unreasonable service to expect. Since the need for better tank refractories is so generally felt the Bureau has deter-

mined to conduct an investigation covering the various typical brands now used to determine, if possible, the relation between refractory composition, conditions of service and life. In order to get the investigation under way 27 small tanks have been made using refractories which are typical of dense and open burned aluminous and siliceous brands, as well as brands of medium composition. These will be subjected to the corrosive action of a soda-lime glass at high temperatures and the reactions obtained will be correlated, if possible, with the various types of refractories used.

A Study of the Factors Affecting the Life of Boiler Setting Refractories

The need has been felt for a long time of a better test covering the resistance of boiler setting refractories to slagging. Although the investigations which the Bureau has carried out on refractories for the development of specifications have shown that the service can be predicted with fair accuracy from the results of certain tests, it seems desirable to develop a laboratory slag test in order that factors of composition, both of the slag and refractory and their comparative effect on the life of brick, may be determined. The apparatus necessary for carrying out such a test has been designed and constructed and it is proposed to observe the effect of high, medium and low fusing clinker on various brands of refractories. Test panels of the brick to be investigated will be brought to a high temperature by means of a blast impinging on the brick. Finely ground and artificially prepared clinker will be introduced into the flame and in this way brought into contact with the test panel.

STANDARDIZATION, THE BULWARK OF STRENGTH AND PROGRESS OF INDUSTRIES IN GERMANY

Standardization of industrial production has been one of the important factors in enabling Germany to maintain its industrial machine intact, in the face of the multitude of obstacles now confronting that country.

"The extent to which Germany has so far succeeded in keeping her industrial machine intact, is due in no small part to the elaborate scale on which her standardization work is performed," it is stated by Dr. P. G. Agnew, Secretary of the American Engineering Standards Committee, who recently returned from Europe, where for two months he made a study of the standardization movement and the manner in which European developments in this direction are likely to affect American industry.

"The elaborateness of the organization for the work, its activity, and the scale on which it is being carried out constitute a new development in industrial organization.

"Practically every important manufacturing concern in Germany is officially participating in the industrial standardization program of that country. More than a thousand German companies have formal standardization organizations within their own works. These organizations are called 'standards bureaus.' The larger firms have branch bureaus in the separate departments, or in the separate factories. One of the well known companies has twenty-one such branch bureaus, employing in all a special staff of more than one hundred. Another firm has a permanent full-time staff of over two hundred in its various branch bureaus. In all of the great firms the bureau reports directly to the general manager."

The extent to which industrial life in Germany has been coördinated, it is stated, is shown by the fact that more than seven hundred German national standards have been adopted. This includes only those in which several different industries are concerned, and which are approved by the central national body. These include fundamental engineering standards as: standard diameters, tapers, sizes of keys, threads,

fits, etc.; materials, tools, measuring instruments and gages, machine parts, including handles, ball and journal bearings, etc.; gears, and sizes of paper.

In addition to this work of the central body, and closely correlated with it are no less than sixty-five special industry committees actively working on such subjects as: the standardization of pipe fittings, piping, and accessories, welding, steel construction, concrete and reinforced concrete, fire fighting equipment, windows, doors and stairways, foundry practice, the printing trades, merchant marine, locomotives, motor trucks, laboratory apparatus, photographic supplies, non-ferrous metals, precision tools, sand, gravel and street paving material, typewriters, highway bridges, rolling mills, and railway car construction.

A striking example is cited of the efficiency of national standardization as it has been developed in Germany, in the case of a rush order placed with German manufacturers for 200 locomotives for delivery to Russia. "Production of different parts was allotted to seventeen different manufacturers to be produced strictly upon the plan of interchangeable parts, no one manufacturer making a complete locomotive. No serious practical difficulty was encountered in filling the order. The inspectors made a particularly striking test of the feasibility and accuracy of the plan by ordering a complete locomotive to be assembled from parts chosen at random from the parts furnished by the seventeen manufacturers. It proved to be ready for service immediately after assembly without the necessity of any disassembling for readjustment.

Standardization engineering is now a recognized profession in Germany. The rapid development of standardization organizations within the companies has made a large demand for such work. Advertisements for standardization engineers and for such positions regularly appear in the engineering press.

An interesting development of the last few years is the appearance of consulting engineering firms specializing in standardization work. There are now five such firms in Germany. This work is closely connected with industrial or efficiency engineering, in which there is now great and growing interest in Germany. In general, it appears to be much more closely connected with the movement for industrial standardization than is the case in this country. The largest of these firms devotes about half of its time to standardization work, employing a staff of over forty. They have as their clients trade associations as well as individual firms, the latter including both large and small companies.

One of their clients is the trade association representing the motor vehicle industry. In this work they perform many of the services that would be done by an ordinary headquarters standardization staff.

Of the companies which are their clients, some maintain their own standards bureaus, which take care of the greater part of the detailed work, leaving to the consulting firm only the more important and difficult questions. In other cases, the consulting firm does a large amount of the detailed work.

Another most interesting development is the work of consulting engineers on trade catalogs for companies. This is particularly significant, as it is carrying standardization a step farther than is usual, by introducing it into the sales organization and sales policy. In this, careful consideration is given to the question of limiting the number of types, ranges and sizes offered for sale, placing proper emphasis in the catalog on these particular items on which the company wishes to concentrate, and, in general, in featuring and often advertising the relation of the firm's products to the standardization movement.

CALENDAR OF CONVENTIONS[1]

Organization	Date	Place
AMERICAN CERAMIC SOCIETY	Feb. 4–9, 1924	Atlantic City
(Annual Meeting)		
(Summer Meeting)	July 21–Aug. 16, 1924	Trip to Pacific Coast
American Concrete Institute	Feb. 25–28, 1924	Chicago
American Institute of Electrical Engineers	Feb. 4–7, 1924	Philadelphia
American Zinc Institute	May, 1924	St. Louis, Mo.
Assn. of Scientific Apparatus Makers of U. S. A.	April 18, 1924	Washington, D. C.
Common Brick Mfrs. Assn. of America	Feb. 11, 1924	Los Angeles, Calif.
Institute of Metals, Div. of American Institute of Mining and Metallurgical Engineers	Feb., 1924	New York City
Natl. Assn. of Stove Mfrs.	May 7–8, 1924	New York, Hotel Astor
Natl. Bottle Mfrs. Assn.	April 27, 1924	Atlantic City
Natl. Brick Mfrs. Assn.	Jan. 28–Feb. 2, 1924	Cincinnati, Ohio
Natl. Builders Supply Assn., Inc.	Feb. 11, 12, 1924	St. Louis, Mo.
Natl. Electric Light Assn.	May or June, 1924	
Penna. Gas Assn.	April, 1924	Atlantic City
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	April or May, 1924	(?)
Western Society of Engineers	June 4, 1924	Chicago

[1] Further information may be secured through the Chamber of Commerce of U. S., Washington, and World's Convention Dates, New York, N. Y.

BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical and Scientific Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Mary G. Sheerer, H. S. Kirk, R. R. Danielson, H. G. Wolfram — Art, Enamel

G. E. Barton, A. N. Finn, F. A. Harvey, R. F. Ferguson, F. H. Riddle, C. C. Treischel — Glass, Refractories, White Wares

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Vol. 3 March, 1924 No. 3

EDITORIAL

OUR LEADERS

How to Find Facts
How to Recognize Facts
How to Use Facts

February was the birthday month of two of America's foremost leaders, George Washington and Abraham Lincoln. The thought from the lives of these two men to be developed here is that at all times throughout their youth and their later years of service, they were in constant studious application of fact-finding and using. School days were not their limit of time devoted to study.

Such is the record of every man who is successful through his own efforts. It is the untiring and "always at it" application that makes big industrial successes from small beginnings. It requires a continual drive to find, to recognize and to use facts.

A University graduate employed by a concrete contracting concern applied to this office for information on calculation of openings in revolving screens. He had not learned how to find facts. He probably will never know how to recognize facts and to use facts, largely because he had no plan for working diligently and systematically; he was not educated and was making no effort to acquire an education.

Education can be summed up in this three-fold formula of how to find, how to recognize and how to use facts. This is why schooled-trained men have no monopoly on education, and at the same time, it is the cause for so many college graduates being without an *education*.

"Broke at Fifty" is the title of a story written by R. L. Dollings of his eighty million dollar failure. His opening paragraphs have as their central thought that being broke at 13 or 22 when you are physically most fit, and when fear is an unknown quantity, and when the beckon of adventure is more than welcomed is not so serious a matter, but being broke at 50 is really serious. At fifty the machine is worn, some of the assurance is gone; "hesitation has succeeded the dash of impulse" and the nearness of the inevitable rainy day is evidenced by "just a mist at first and only a few scattered clouds, and you think you are as fit as ever, but life is the old story of the prize ring—the good old man will always go down before the good young man."

What a warning, what a sermon by one who by experience knows. But Youth will not be told; he will not take heed. It will be the oft repeated story of neglected use of Youth's opportunities and fitness to acquire.

The big idea of the American Ceramic Society is to inspire and to assist young men to acquire the education of how to find, to recognize and to use facts so that when he reaches the age when his faculties are less keen and his ability to acquire habits is very much less, he will have acquired the educational habit and impetus for which and only for which salaries are paid. The Society not only aims to furnish the inspiration but also the assistance in the acquiring of these fact finding and using requisites. It is for mutual help in furnishing the inspiration and assistance which no one laboring alone could acquire that the members of the Society are collaborating.

General Washington learned the importance of united effort. He influenced the writing of this lesson into the Constitution of the United States. President Lincoln's prime motive was preservation of this Union of effort. The principle holds in educational affairs as it does in statesmanship.

PAPERS AND DISCUSSIONS

A DUST COLLECTING SYSTEM[1]

By B. E. Whitesell

ABSTRACT

This paper describes the principle on which a dust collecting system installed at the Salina Plant of the Kier Fire Brick Co., Pittsburgh, Pa., operates. It also includes some of the factors considered in the designing and a description of the installation and operation.

Principle on Which the System is Based

Dust-laden air can be conveyed through pipes by connecting them to an exhaust fan, the fineness and specific gravity of the dust determining the velocity head necessary to convey the dust to the point desired. The volume of air required to carry the dust depends on the size of the dust particles and weight per cubic inch, as well as the dust hood necessary to retain the dust at its source.

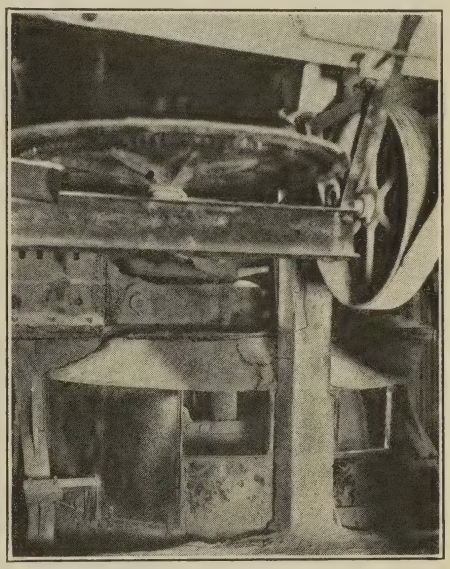


Fig. 1.

For a given fan, piping system and density of air, the following relations hold: cubic feet of air per minute (c.f.m.) varies as the revolutions per minute (r.p.m.); pressure α (r.p.m.)^2; brake horsepower (b.h.p.) α (r.p.m.)^3. It is evident, then, that the less air handled, the less h. p. will be required. In order that the most benefit may be derived from this fact, under working conditions, dampers are installed near the fans and bins so that any part of the system not in use can be shut off, resulting in a still further decrease of h. p. required, as this portion of the air is not handled.

The proper place to collect the dust is at its source, since the more it is allowed to spread the more air that must be handled and purified; and since the volume of air and its required velocity determine the size of pipes a system permitting of smaller pipes, simplicity, efficiency, and less cost to install and operate would result. The cost of installation increases in direct ratio to the volume of air handled.

[1] Recd. Dec. 29, 1924. Presented at the Atlantic City Meeting, February, 1924. (Refractories Division.)

By providing a means of dust separation (the arrester in this case) the air velocity through such is reduced below that value of velocity head that will move or carry the dust, thus depositing it in the bins of the arrester. Again, if baffle plates are used to reduce the air velocity, the settling action or separation of dust and air is increased.

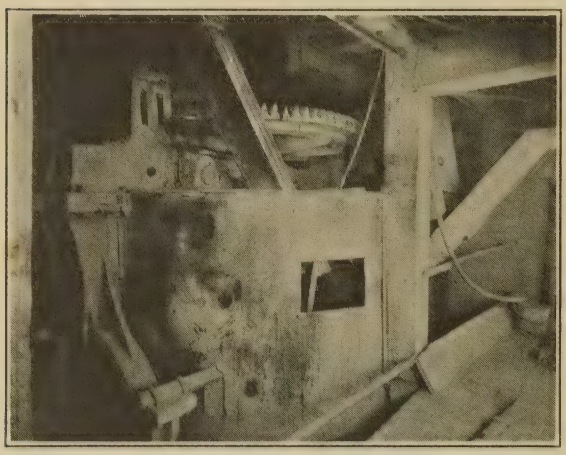


Fig. 2.

The arrester screens being of suitable mesh, the remaining fine particles of dust are taken from the air, leaving it clean as it passes to the outside or is returned to the building for heating purposes.

Designing

This system was designed to take care of four dry pans and three plastic clay bins.

The hoods over the dry pans were designed so that the dust would be confined in the smallest space possible. They were also made as tight as working conditions would permit so as to limit the amount of air entering in order to concentrate, as much as possible, the dust content per cu. ft. of air. The first hood constructed is shown in Fig. 1. A better construction and the one recommended is shown in Figs. 2 and 3, this hood being simpler to build and permitting of easier removal for repairs to the dry pan.

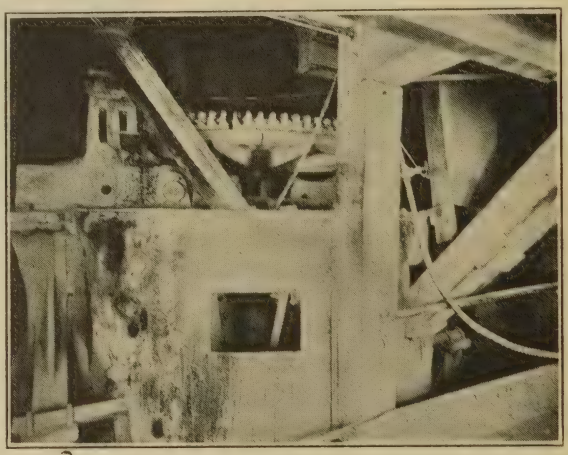


Fig. 3.

Careful consideration was given to the amount of dust that would be handled; the size of particles, in order to reduce the rate of abrasion in the galvanized steel pipes, together with an equally important value, namely, as little

loss as possible in friction in order to make the whole installation cost a minimum h. p. operation; and to the static pressure lost in the entire system.

Considering all the above items, the selection of the proper size arrester, fan and pipes is very important.

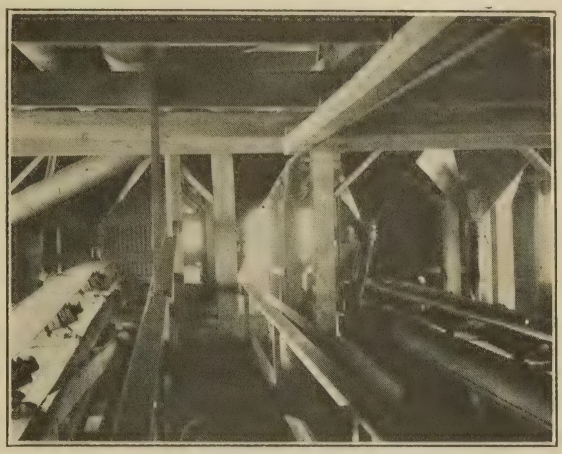


Fig. 4.

Description of Arrester

The arrester is manufactured by the W. W. Sly Manufacturing Co., Cleveland, Ohio.

It is of the cloth screen type containing large areas of filtering surface confined in a comparatively small space.

Cloth is claimed by the manufacturers to be a better filtering medium and should be fairly open so as not to produce too much back pressure. The threads should be fine as possible to make the weave loose and durable. The loose fibers on the individual threads, or the nap of the cloth, make the air passages so fine that practically the smallest particle of dust will be retained.

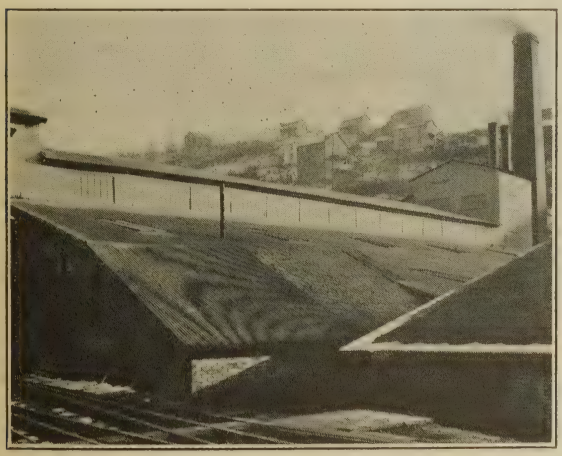


Fig. 5.

Each screen, being 9 feet by 3 feet $4^3/_8$ inches, is double, which gives it an area of 60 square feet. Since there are four screens to the running foot and the arrester is 18 feet long, there is a total screen area of 4320 square feet.

The greater the filtering or screen area in proportion to the volume of air, the looser the dust will lie on the cloth, which is important because the velocity of the air through the cloth should be low so that none of the dust will be drawn into the meshes, but will form a very loose and

fluffy layer on the surface without obstructing the passages of air to any great extent. Also, the screen will retain its filtering capacity longer without shaking the dust down.

The removal of dust accumulation from the screens is accomplished by a rapping device direct driven from a 1 h. p., 1200 r.p.m. motor.

The arrester, the inside dimensions of which are 9 feet $10^5/_8$ inches high plus 3 feet 10 inches for the hoppers, 7 feet 10 inches wide and 18 feet long, is divided into two sections, an 8-foot section and a 10-foot section. The 8-foot section collects from the pan grinding plastic clay and three plastic clay bins, while the 10-foot section collects from the three pans grinding the mixes for the brick machines.

Location of Arrester

The arrester is located directly over two storage bins which permits the hoppers of the arrester to be emptied directly into the bins. The location can be seen in Figs. 4 and 5.

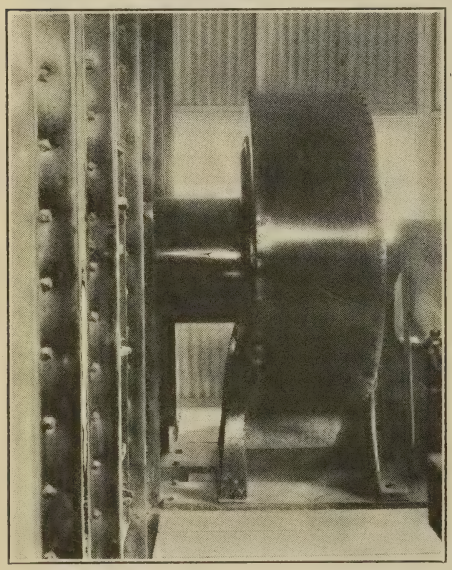


Fig. 6.

Fan

A No. 23 ES special steel plate exhaust fan, made by the American Blower Company, was chosen. It has a large diameter wheel of proper blast area to handle approximately 12,000 c.f.m. operating at 780 r.p.m., requiring under this condition 18.8 h. p. measured at 70°. The fan is shown in Fig. 6.

A type ES, 20 h. p., 1160 r.p.m. Westinghouse motor, having an 8-inch diam. pulley is used to drive the fan.

Pipes

The size of the pipes or branches necessary to carry the dust from the dry pans was first determined.

Each of the plastic clay bins is provided with a 7-inch pipe or branch; each of the dry pans grinding the standard mixes, consisting of flint clay ground to 3-mesh and finer, plastic clay of 30-mesh and finer, and grog or crushed brick bats, is provided with a 9-inch branch; while the pan grinding plastic clay and fire clay to 30-mesh and finer has a 10-inch pipe leading from it to the plastic clay side of the arrester.

These three branches from the bins are connected to a main pipe.

At each point where a branch enters the main, the main pipe area is increased an amount equal to that of the branch added, so that this main pipe increases from 7 inches at the farthest point from the arrester to 13 inches where it enters the arrester. This main also leads to the plastic clay section of the arrester. The three 9-inch branches from the dry pans are connected to a main whose smallest diameter is 9 inches and the largest diameter (the point where it enters the arrester) being 17 inches. This pipe enters the other section of the arrester. Fig. 7 shows the three main pipes entering the arrester.

Besides being designed with the easiest elbow turns (45° or less), as few angles as possible are used.

The main pipes are made of 20 ga. galvanized steel and the branches of 22 ga. All joints are riveted and soldered, keeping the bottom side level.

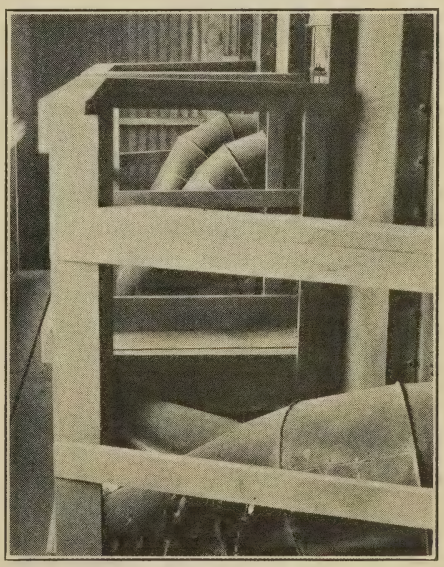


Fig. 7.

Operation

The man in charge of the clay distributing belt has charge of the dust arrester. About ten minutes of his time is required to look after the arrester and motor each day, except one day each week when he inspects the entire system. This requires about one hour.

In the evening, after the day's run, the fan is stopped and the rapping device is run for three minutes to shake the fine dust from the screens. If the fan is running while the screens are being rapped there is a tendency for the dust to be drawn through the cloth into the clean air side of the arrester. After rapping the screens, the gates at the bottom of the hoppers are opened and the hoppers allowed to empty, the plastic clay emptying into a plastic clay bin and the standard mix emptying into a flint clay bin by gravity.

The system is then ready for operation the following morning.

Remarks

It is difficult to get the average amount of dust collected daily, since the plastic clay dust will vary from 150 to 400 pounds for eight hours and the standard mixes from 120 to 180 pounds per pan for eight hours, depend-

ing on the condition of the clay as it enters the pan and the amount of water added in the pan. The clay contains enough moisture when it leaves the pans so that it can be conveyed to the machines by conveyors and chutes without causing any dust. In an operation where no water is added the amount of dust collected would be considerably increased.

Between 450 and 500 pounds of dust are collected during the ten hours required for the grinding of one car of fire clay.

Screen analyses show that 99%+ passes through a 200-mesh screen and 100% through a 150-mesh.

The system has been in operation thirteen months and the only expense has been the repainting of the inside of the arrester. This was done while a thorough inspection was being made of the entire equipment.

The Kier Fire Brick Co.
Pittsburgh, Pa.

BUREAU OF ENGINEERING SPECIFICATIONS, LENSES AND GLOBES[1]

General Specifications

1. General Specifications for the Inspection of Material, issued by the Navy Department, in effect at the date of opening of bids, shall form part of these specifications.

Classes and Grades

2. Glassware furnished under these specifications shall conform to the following classes and grades, as specified in the requisition or schedule.

Class 1

Navy Standard Fresnal Lenses

Grade	
A	Clear
B	Red
C	Green
D	Blue

Class 3

Navy Standard Glassware

Grade	
F	Translucent
G	Red globes
H	Green globes
I	Blue globes

Class 2

Grade

E for Navy Standard heat resisting clear globes

Material, Workmanship, etc.

3. The material and workmanship shall be first class in every particular. The terms "Lead glass," "Lime glass," "Zinc glass," "Zinc-borosilicate glass," "Borosilicate glass," and "First class workmanship," as referred to in these specifications, shall be defined as follows:

[1] Received Dec. 1, 1923. Presented at the Atlantic City Meeting, February, 1924. (Glass Division.)

(*a*) *Lead glass.* A glass composition which contains not less than 22% of lead oxide in the finished lens, and whose specific gravity is not less than 2.90.

(*b*) *Lime glass.* A glass composition which contains between 3.5% and 5% of lime (CaO) and less than 15% of lead oxide in the finished glassware and whose specific gravity is not less than 2.60.

(*c*) *Zinc glass.* A glass composition which contains between 12% and 15% of zinc oxide (ZnO), less than 15% of lead oxide, is free from any appreciable lime (CaO) in the finished glassware, and whose specific gravity is not less than 2.60.

(*d*) *Zinc-borosilicate glass.* A glass composition which contains not less than 7.5% of boric anhydride and between 13% and 15% of zinc oxide in the finished glassware, and whose specific gravity is not less than 2.50.

(*e*) *Borosilicate glass.* A straight boric anhydride glass containing not less than 13% of boric anhydride, not more than 1.5% of aluminum and iron oxides, and free from all other metallic oxides. The specific gravity shall be not less than 2.28. This glass is for Class 2 (heat resisting) glassware only.

(*f*) *Workmanship.* First class workmanship shall mean, among other things, that all finished glassware shall be free from air bubbles, striae, wrinkles, mold marks, chipped edges or any other blemishes which may affect its optical qualities, mechanical strength or good appearance; uniformity in the thickness of illuminating glassware, uniformity in the color density of all colored glassware, and a uniform refractive index for all glassware of the same class and grade furnished under one contract; and having finished dimensions coming well within the tolerances specified on the drawing.

General Requirements

4(*a*) All glassware shall be in strict accordance with the Navy drawings specified in the requisition, order or schedule.

(*b*) Where the thickness tolerances are not shown on the drawing a variation of 12% above or below the nominal dimension will be permitted, provided, however, that this tolerance shall in no case exceed $^1/_{16}$ inch. Where the tolerances are shown on the drawing the permissible variation shall be within the limits shown thereon.

(*c*) The edges of all lenses, globes or shades shall be either ground or molded to a true surface.

(*d*) The refractive index of the glass for any purpose is optional with the manufacturer but this index shall be uniform for that product. The manufacturer shall state to what index base the calculation of the lens contour has been developed, in the design of the Fresnal lenses. This

information shall be furnished the Inspector when material under a Navy contract or order is submitted for inspection.

(*e*) Glassware shall be in strict conformity with Tables I and II hereunder, with respect to color density and light transmission. Table I is given in terms of the actual transmission of light in percentage of the light source, on the basis of the candlepower standard. Table II is based on the standards of the Railway Signal Association at 100%.

(*f*) All colored glassware shall be of uniform color density per millimeter thickness, and the glass shall be solid color. Flashed glass will not be satisfactory.

TABLE I

TRANSMISSION IN ACTUAL PER CENT OF LIGHT SOURCE ON CANDLEPOWER BASIS

Class	Grade	Type	Per cent normal	Per cent maximum	Per cent minimum	Per cent deterioration after 1 year service
1	A	Navy Standard Clear	95	100	90	10
1	B	Navy Standard Red	7.5	9.4	5.6	20
1	C	Navy Standard Green	2.75	3.5	1.75	25
1	D	Navy Standard Blue (L. V.)	0.75	0.90	0.60	25
2	E	Navy Standard Clear (H. R.)	0.80	87	70	15
3	F	Navy Standard Translucent	65	100	50	10
3	G	Navy Standard Red Globes	9.35	10	7.5	20
3	H	Navy Standard Green Globes	11.6	12.5	10	25
3	I	Navy Standard Blue Globes (L. V.)	0.75	0.90	0.60	25

TABLE II

TRANSMISSION ON BASIS OF RAILWAY SIGNAL ASSOCIATION 100% STANDARD

Base 100% Red = 9.35% Actual Transmission
Base 100% Green = 11.6% Actual Transmission

Class	Grade	Type	Standard	Light limit	Dark limit
1	A	Navy Standard Clear	...	...	...
	B	Navy Standard Red	100%	100	60
	C	Navy Standard Green	100%	30	15
	D	Navy Standard Blue (L. V.)	...	...	...
2	E	Navy Standard Clear (H. R.)	...	...	...
3	F	Navy Standard Translucent	...	...	...
	G	Navy Standard Red Globes	100%	107.7	86.2
	H	Navy Standard Green Globes	100%	106.9	80.2
	I	Navy Standard Blue Globes (L. V.)	...	...	...

(*g*) All glassware furnished under these specifications shall have the manufacturer's name or trademark permanently impressed in each piece. In the case of Lenses (Class 1) this marking shall be made in the central zone or bull's eye. Heat resisting globes (Class 2) shall have this marking on the outer surface of the globe, near the edge. Globes for general illumination (Class 3) shall have this marking molded or pressed on one edge.

Detail Requirements

Class 1. Lenses

5(*a*)1. Fresnal lenses for navigational and signal lights. The glass shall be of such composition as to withstand the action of the elements, particularly that of salt water, without etching, discoloration, change in the color density of colored lenses, or any change in the light transmission of the finished glassware beyond the limits specified in paragraph 4(*e*) of these specifications.

(*a*)2. Clear, green and blue lenses (Grades A, C and D) shall be made from the best quality of lead glass.

(*a*)3. Red lenses (Grade B) shall be of the so-called selenium red glass and shall be made from the best quality of zinc-borosilicate glass.

(*a*)4. Fresnal lenses shall be designed to have a central bull's-eye and 4 zones above and 4 below this central zone. The mathematical design of the lens shall be such as to produce not more than an 8° dispersion above or below the horizontal axis of the central bull's-eye when used with a standard 40 watt incandescent lamp located at the focus of the system. Actual figuring of this design shall be at the option of the manufacturer as to the surface curvatures, spacing of zones, width of zones, etc., and the statement of the mathematical derivation of this design will not be required to be furnished by the manufacturer.

(*a*)5. The design of the system as a Fresnal lens shall be such that the rays emitted by a light source of a $^1/_4''$ sphere, placed at the focus of the system and passing through the system, shall emerge parallel. When the lens, with the above type of light source, is viewed at a distance of 20 feet along the horizontal axis of the bull's eye the zones shall all appear equally illuminated, the light showing through the zones as an uninterrupted vertical strip about $^1/_4''$ wide, for the entire height of the lens.

(*a*)6. Lenses shall be so designed and constructed as to be capable of withstanding an external hydrostatic pressure of 100 pounds per square inch indefinitely, when mounted in a support so designed as to produce a minimum strain on the lens.

(*a*)7. The several grades of glassware (A, B, C and D) furnished under Class 1 shall be subject to the following individual grade requirements:

(I) *Grade A—Clear.* The glass shall be free from perceptible tint when viewed through the lens. The entire visible spectrum of the light source shall be transmitted with color selection at any wave-length being kept below $^1/_2$ of 1%. The light transmission shall be in accordance with Table I.

(II) *Grade B—Red.* The glass shall be of such color quality that all light of shorter wave-length than 0.630 micron shall be absorbed, transmitting only red and orange light. All rays emitted by the sodium flame shall be completely absorbed. The color density and light transmission shall be in conformity with Tables I and II of these specifications.

(III) *Grade C—Green.* The glass shall be of such color quality as to absorb all of the light of longer wave-length than 0.570 micron, transmitting only violet, blue and green light. The color density and light transmission shall be in conformity with Tables I and II of these specifications.

(IV) *Grade D—Blue.* The glass shall be of such color quality that all light of longer wave-length than 0.489 micron shall be absorbed, transmitting only violet and blue light. The glass shall not, under any condition of light source, transmit any red or yellow light. The color density and light transmission shall be in conformity with Table I of these specifications. The glass of the lens shall, when used with a 25-watt standard tungsten lamp operating at rated voltage, show a direct visibility not to exceed 1000 yards; and, the indirect reflected rays shall not be visible over 200 yards on a dark night with a clear atmosphere.

Class 2. Heat Resisting Globes

5(*b*)1. *Grade E.* The glass shall be of a special heat resisting type and shall have an extremely low temperature coefficient of expansion. The unmounted heat resisting globe shall be capable of withstanding the internal stresses produced when the globe is heated uniformly to a temperature of 150°C and then suddenly and completely, or partly, immersed in water at 10°C, or, it shall be capable of withstanding a sudden change in temperature of 140°C. Under this treatment the glass shall not be injured in any way, either visibly or structurally. It shall be capable of withstanding this treatment repeated indefinitely.

(*b*)2. The glass shall be either a "Lead glass" or a "Borosilicate glass." It shall be of such composition as to withstand the action of the elements, particularly that of salt water, without etching, discoloration, or any change in the light transmission of the finished glassware beyond the limits specified hereunder.

(*b*)3. The glass shall be clear as to light transmission and it shall show

a light absorption not to exceed 4% for white light, nor a selective absorption exceeding $^1/_2$ of 1% for any wave-length between 0.420 micron (violet) and 0.680 micron (red).

(*b*)4. The glass shall be suitable for use as an outer globe in a fixture in which a filter lens (Class 1—clear, red, green or blue—see paragraph 5(*a*)1 to 5(*a*)7, incl.) is used, without materially affecting the total light transmission of the assembly. When used with a filter lens, which lens in itself complies with these specifications, the combination shall show a light transmission within the limits of Tables I and II for the particular grade and color of lens with which the heat resisting globe is used.

(*b*)5. The glass shall be reasonably free from striae, bubbles, wrinkles or other defects which may be considered detrimental to its appearance, optical qualities or serviceability. The glass shall be of such mechanical strength as to render it capable of withstanding for an indefinite period, a continuous or fluctuating external hydrostatic pressure of 300 pounds per square inch, when permanently mounted in the fixture in which it is designed to be used.

Class 3. Globes

5(*c*)1. The glassware under this class may be of any stable commercial glass composition excepting a zinc glass. It shall be of such composition and quality as to withstand the atmospheric sea conditions which exist below deck without etching, discoloration or a change in color density or light transmission beyond the limits specified in Tables I and II.

(*c*)2. Globes or shades shall show no defined dead spots when illuminated from the inside and viewed from the outside. The glassware shall be of uniform thickness, within the tolerances specified.

(*c*)3. *Grade F—Translucent.* The translucent glass shall be of a totally diffusing milk glass, of uniform density, and shall be so made as to break up the light and eliminate any light source image. The glass shall transmit the entire spectrum, with absorptive selection in the red end of the spectrum desirable but not imperative. The light transmission shall be in accordance with Table I of these specifications.

(*c*)4. *Grade G—Red.* The glass shall be of such color quality that all light of shorter wave-length than 0.630 micron shall be absorbed, transmitting only red and orange light. All rays emitted by the sodium flame shall be completely absorbed. The color density and light transmission shall be in conformity with Tables I and II of these specifications.

(*c*)5. *Grade H—Green.* The glass shall be of such color quality as to absorb all of the light of longer wave-length than 0.570 micron, transmitting only violet, blue and green light. The color density and light transmission shall be in conformity with Tables I and II of these specifications.

(*c*)6. *Grade I—Blue.* The glass shall be of such color quality that all light of longer wave-length than 0.489 micron shall be absorbed, trans-

mitting only violet and blue light. The glass shall not, under any condition of light source, transmit any red or yellow light. The color density and light transmission shall be in conformity with Table I of these specifications. The glass of the globes shall, when used with a 25-watt standard Tungsten lamp operating at rated voltage, show a direct visibility not to exceed 1000 yards; and, the indirect reflected rays shall not be visible over 200 yards on a dark night with a clear atmosphere.

Method of Inspection, Tests, etc.

6. Inspection at the place of manufacture shall consist of the following:

(*a*) *Dimensional and Surface Inspection.* Each piece of glassware submitted for inspection under a contract or order shall be subjected to a careful inspection to ascertain that the dimensions are within the specified

TABLE III

No. of samples	No. of pieces of same type, class and grade, submitted in one lot or fraction thereof
1	25
2	100
3	200
4	500
5	1000
6	1500
7	2000
8	5000
10	10000

NOTE: The samples referred to in the above table refer only to glassware which is satisfactory to the Inspector as regards dimensions and workmanship. For samples which refer to rejected material under controversy see paragraph 8(*d*) of these specifications.

tolerances and that the workmanship is first class in every particular. The naval inspector concerned shall be the judge as to the size and number of small bubbles, striae, mold marks, wrinkles, chipped edges or other slight blemishes which are sufficient to detract appreciably from the serviceability of the lens or globe.

(*b*) *Specimens for Laboratory Tests.* Lenses or globes, to the quantity indicated in Table III hereunder, shall be selected by the Naval Inspector for forwarding to the Government Laboratory designated by the Bureau concerned. The samples shall be selected after the dimensional and surface inspection referred to in sub-paragraph 6(*a*) above has been made and they shall represent the poorest of the lot which, in the Inspector's judgment, are otherwise acceptable. No two samples shall come from the same pot of molten material.

(*c*) *Color Density and Light Transmission Tests.*

(I) *Lenses (Class 1).* The tests for light transmission of a lens shall be made on the basis of the average of transmission. Tests shall be

made by illuminating the entire lens and photometrically reading the transmission of light. Color density shall be rated likewise, the spectrum analysis being taken with the entire lens illuminated and the spectroscope placed at a distance which will bring the entire lens into the field of the spectroscope.

(II) *Globes (Classes 2 and 3).* The testing of glassware under Classes 2 and 3, for color density and light transmission, shall be made on a section of the globe, taking various photometric and spectroscopic measurements on sections 1″ in diameter by blocking off the remainder of the globe. The transmission and spectral values for all sections or zones shall fall within the limits of Tables I and II of these specifications. The appearance of dead streaks in any of the material, even though the tested zones fall within the specified limits of transmission, shall be cause for the rejection of the material.

(*d*) *Chemical Analysis and Weathering Tests.* Chemical analysis shall be made of the material of the samples, to ascertain that the composition is in conformity with these specifications. Weathering tests covering a one-year period of time shall also be made when, in the opinion of the Government Laboratory concerned, there is reason to question the suitability of a particular glass composition for the service intended. Acceptance of material submitted under contract or order will not, however, be contingent upon the result of such tests unless there be grave doubt upon this point, in which case the contractor will be required to make out a special guarantee to cover a period of one year.

(*e*) Any further tests which, in the judgment of the Bureau concerned, are necessary to ascertain that the material submitted is in full conformity with these specifications.

Packing and Marking of Shipments

7(*a*) Glassware shall be suitably packed for shipment in strong wooden cases or barrels. The method of packing shall be such as to prevent breakage, chipping or marring of the glassware during shipment. Each lens, globe or shade shall be individually wrapped in paper of the color corresponding to the color of the glass.

(*b*) All packing cases shall be plainly marked with the manufacturer's name, the contract, requisition or order number, the quantity, and the class and grade as defined in paragraph 2 of these specifications.

Notes to Supply Officers, Bidders, Manufacturers and Others

8(*a*) All requisitions, schedules or orders shall specify the Class and Grade as defined in paragraph 2 of these specifications, and the number of the Navy Drawing, or Drawings, which apply.

(*b*) Bids for furnishing glassware differing from the requirements of these specifications will be considered, provided the bidder clearly describes in his bid the specific points in which the glassware he proposes to furnish differs from the requirements of the specifications, and provided further that the differences are indicated as such. When exceptions are not clearly described and indicated as such it will be assumed that bidders are offering glassware in strict accordance with these specifications.

(*c*) Government purchases of glassware under these specifications shall cover not less than 25 pieces of each type on order. By "each type" is meant all lenses or globes made to the same drawing and coming within the same grade classification. Refer to paragraph 2 of these specifications.

(*d*) In the event of a controversy between the contractor and the naval inspector relative to the acceptability of lenses or globes which contain slight striae, bubbles, mold marks or wrinkles, the procedure which is to be followed by the contractor in making an appeal shall be as follows: the inspector shall select one or more samples for forwarding to a government laboratory to be designated by the Bureau concerned. The sample or samples so selected shall represent the poorest specimens of the lot of glassware under controversy. The selected samples shall be marked by the inspector in such a way as to positively preclude any chance of substitution and are then to be shipped by the contractor, at his own expense, to the government laboratory designated. The Laboratory will investigate the effect of such blemishes upon the serviceability of the material in question and render its report to the inspector, a copy of such report, with recommendations, to be forwarded to the Bureau concerned for its information. In the interim between the forwarding of such controversial samples to the Government Laboratory and the receipt by the inspector of a test report therefrom, the material involved at the contractor's works shall have the status of rejected material, and any delay in deliveries under the navy contract or order shall not be attributable to the government. An appeal from the Inspector's decision, the proper procedure for which is outlined above, is to be considered in the light of a privilege conferred by the Bureau concerned, which privilege may be withdrawn whenever, in its judgment, withdrawal is considered desirable.

(*e*) Copies of these specifications may be obtained upon application to the Bureau of Engineering, Navy Dept., Washington, D. C.

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

Contributed discussions covering questions of interest to the refractories manufacturer and consumer will appear each month in this department. A list of questions, some of which were considered at the last annual

meeting, is printed herewith. The membership is requested to submit additional questions and to contribute to the discussion of such questions as they have information on. It is planned to give one or more questions a thorough treatment each month. Anyone wishing to submit discussions will send them to the office of the General Secretary properly marked for this department. Author's name should be signed, but may be withheld if requested.

Question: What is the value of the poidometer to a manufacturer of refractories?

(1) The poidometer may be used to feed material at a uniform rate to a pan, pug mill, or other machine.

(2) The poidometer is a continuous machine, that is not intermittent in its operation, and measures materials accurately by weight, therefore two or more poidometers may be used to advantage to properly proportion materials to be mixed as they are fed to a pan or pug mill.

(3) The poidometer is adapted to feed ground fire clay at a uniform rate to a pug mill feeding an auger machine, from which auger machine a column of uniform stiffness is desired.

(4) The poidometer is also furnished, when desired, with a water attachment, which furnishes water at a uniform rate for mixing with the clay.

(5) This water attachment, when desired, can also be connected to the parts controlling the flow of clay so that any change in density in the clay due to its change in moisture content may be compensated for by an increase or a decrease in the water supply as needed.

(6) Manufacturers of fire brick ship ground fire clay and manufacturers of silica brick, silica cement, and the poidometer may be used to weigh these materials continuously as they pass from the grinding equipment to the railroad cars in which they are loaded. We contemplate at this time purchasing a poidometer for use in weighing ground fire clay.

S. M. Kier. Pres., Kier Fire Brick Co., Pittsburgh, Pa.

Discussion on Cupola Bricks:

1. Should a cupola block be hard burned?
2. Will a repressed cupola block give better service than a hand-made block?
3. Is it better to use a high-grade bond clay or a low-grade bond clay in cupola blocks?
4. If cupola blocks come from the kiln soft, does it affect their wearing qualities to reburn them in the kilns?
5. What fusion point is desirable in a cupola block?

One of the first requirements for cupola blocks is that they be hard burned.

As a rule, machine made and repressed brick are more uniform in size and shape than hand-made blocks. This, of course, is an advantage, and if there is no pronounced tendency to lamination the repressed brick will give the better service.

If a high-grade bond clay is used, very little or no flint clay will be required. A block made of high grade bond clay and grog without any flint clay will give better service than a block made of a low grade bond clay with a larger percentage of flint clay added.

The writer is not convinced that a reburned fire clay shape is as good as one which has been properly burned the first time. We can give no theoretical explanation for this, but it has been our experience that the reburned ware is liable to be inferior.

About cone 29 is a desirable fusion point for cupola blocks.

E. H. Van Schoick, Manager,
Chicago Retort and Fire Brick Co.,
Ottawa, Illinois

The service conditions to which a cupola block is subjected dictate whether or not it should be hard burned. Large cupolas as a rule require a hard-burned block, particularly in the car wheel foundry. There heavy scrap is charged with a large amount of flux and an all-day melting period is customary. Small cupolas pouring small castings, especially those on stove work, use a medium burned block. These installations have a short pouring period, being operated at a high temperature and pouring the metal very hot to get proper results with thin section castings. A hard-burned block under such conditions spalls badly.

The repressed cupola block is usually more uniform in size than the hand-made block, and will lay up with a much thinner joint. This is desirable, as it reduces the amount of patching caused by erosion and failure of joints.

There are four actions in the cupola which tend to destroy the fire brick lining (from *British Clayworker*).

(*a*) *Corrosion* of lining by furnace gases, fluxes, slag, fuel and molten metal.

(*b*) *Partial fusion* of brick in and near the hearth due to high temperatures.

(*c*) *Spalling* due to sudden temperature changes.

(*d*) *Abrasion* due to rubbing action of the descending charge.

Corrosion by slag is the main cause of failure. A porous brick should not be used, although a viscous slag will not attack a porous brick to any extent. A very fluid slag will attack almost any brick, especially one that is porous. This would indicate a hard-burned block in all cases.

Fusion is very slight. Spalling may be kept at a minimum by skilful furnace operation, even when very hard-burned and dense blocks are used.

Abrasion is usually slight and when hard blocks are laid up into a smooth wall with thin joints, it is not considered an important question. Abrasion

of a rough or patched wall is more or less severe in the case of large cupolas charging heavy scrap.

A refractoriness of cone 31 or over is considered desirable, although a lining with a fusion as low as cone 28 or 29 is satisfactory when the resistance to corrosion, spalling, etc. is suitable.

NOTE: Further discussion of this subject is solicited. Next Month: Discussion of refractories service in the air furnace.

ACTIVITIES OF THE SOCIETY

PRESIDENT'S PAGE

By Robert D. Landrum

This is my first opportunity to address all members of the Society. To the 475 men and 72 ladies registered at the Convention in Atlantic City, I pledged to do all that may devolve upon me as President to further the interests of the Society during the 1924 fiscal year. I wish here to reaffirm this pledge and to make it known to all.

Election to presidency of so large and so potentially and dynamically a useful Society of ceramists is an honor but, of more concern to me, it is a call to service which carries responsibilities and privileges that have caused me to make a thoughtful survey of what we are and what we can become. In this survey is an estimate of what the President should be and should do, which estimate is almost appalling. I find comfort and reasons for expectation of a successful year in the fact that the Society is growing in potency through personal collaboration of an increasing number of earnest men and women. After all, the Society is not what the President, the Secretary or any of the other officers and trustees will it to be; it is just what the members make of it.

Well do I remember the organizing meeting of the Enamel Division. A few men, mostly college trained, met out of curiosity to learn to what extent representatives from competing concerns would disclose information. A real good fellowship and informing time was had. Experiences were exchanged. The meeting adjourned with nearly one hundred per cent conversion of those present to the value of meeting together for the purpose of discussing methods of production. As time passed the number attending and participating increased. The plant operators and college investigators learned a common language so that today the number of factory operators taking an active part has increased many fold.

Rather significant, I take it, that 63% of the 184 papers presented at the Convention just held were from plant operators. This shows an appreciation of the plant man for opportunity to exchange information and experiences.

But neither facts nor information are obtainable without paying a price either by bartering things of like kind or in the coin of the realm. The American Ceramic Society is the exchange market where he who wishes to succeed may, indeed it is almost a case where he must, seek opportunity to exchange the little that is new in his experience for the much which his fellow members give in exchange. This really is the mainspring, the motive, the all-inspiring reason for the existence of the Society.

To so serve as President of this wonderful enterprise of mutual service that the growing confidence and interest will be accelerated at a greater rate during 1924, is my ambition. But I, after all, am only one of the members with a specially assigned task for the while. The burden of responsibility still rests with the members themselves.

MEMBERSHIP WORKERS' RECORD

On February 15, 1924, the grand total of membership in the Society was 2334. The number of personal members was 2030 and of corporations 304.

Our aim is to have each of these 2030 members intense workers for the Society, coping actively with the ceramic problems and situations of the present day. The honor of holding a membership in the Society is betrayed unless that membership is used for vigorous coöperation.

	Individual		Individual	Corporation
R. R. Danielson	1	R. F. Segsworth	1	
I. A. Krusen	1	K. H. Endell	1	
R. F. Geller	1	L. M. Moss	1	
G. H. Brown	1	August Staudt	1	
Thos. A. Shegog	1	A. Malinovsky	1	
Bruce F. Wagner	1	Robt. H. Armstrong	1	
Fred A. Harvey	2	C. C. Treischel	1	
C. W. Parmelee	3	Eugene J. Hysell	1	
J. M. Gilfillan	1	G. W. Cruikshank		1
Donald W. Ross	1	R. D. Landrum		1
James W. Moncrief	1	Francis T. Owens		1
Donald Hagar	1	H. F. Staley		1
W. A. Potter	1	Office	15	4
R. F. Ferguson	1		—	–
		Total	40	8

NEW MEMBERS RECEIVED FROM JANUARY 15 TO FEBRUARY 15

PERSONAL

Armstrong, Chas. C., Mgr., The Armstrong Mfg. Co., Huntington, W. Va.

Bidleman, William J., Mine Supt. and Field Works, Wellsville Fire Brick Co., and Chicago Fire Brick Co., Wellsville, Mo.

Bowles, Fanny Belle, Bldg. 95, Walter Reed Hospital, Washington, D. C., Reconstruction Aide, U. S. Army.

Brown, Leroy Walton, 221 S. Cook Ave., Trenton, N. J., Supt., Lenox, Inc.

Budnikoff, Peter, Professor Engineer technolog of mineral technology, Ivanovo-Vosnesiensk near Moscow, Russia.

Carter, C. C., Supt., Buckeye Tile Co., Chillicothe, O.

Eccles, Alfred Livingston, 16 Atterbury Ave., Trenton, N. J., Sales Engineer, Fletcher Works, Philadelphia, Pa.

Foraker, Ralph L., 1918 S. 48 Court, Cicero, Ill., Ceramic and Efficiency Work, Coonley Mfg. Co.

Griffin, Paul Frederick, U. S. Refractories Corp., Mt. Union, Pa.

Griffiths, Norman, Chemist, Eureka Terra Cotta and Tile Co., Ballarat, Victoria, Australia.

Haldeman, Virgil Kenneth, 318–13th St., Beaver Falls, Pa., Ceramic Engineer, Beaver Falls Art Tile Co.

Harris, Robert W., Dillsboro, N. C., Secy., Harris Clay Co.

Heinle, Frederick John, 34 Highland Ave., Washington, Pa., Engineer, Hazel-Atlas Glass Co.

Horner, E. H., Box 314, Stockton, Calif., Supt., Stockton Fire Brick Co.

Hugill, William, Department of Applied Science, St. George's Square, Sheffield, England.

King, Walter F., Ceramic Engineer and Plant Supervisor, Mosaic Tile Co., Matawan, N. J.

Koehler, Walter A., 39 Maple Ave., Morgantown, W. Va., Instructor, Chemical Engineering, W. Va. University.

Koppers, Dr. Heinrich, Essen, Moltkestrasse 29, Germany.

Lahovsky, Josef, Chief Chemist of the Zápoceské Tovarny Kaolinové a samotivé, Horni Bitza, Czechoslovakia.

Lefranc, Jacques, 29C, Rue St. Martin, Paris III, Chief of Laboratory, Conservatoire Nationale des Arts et Metiers.

Longbotham, Harry, 1711 San Lorenzo Ave., Berkeley, Calif., Pacific Sanitary Mfg. Co.

Lu, Kai-Ching, Box 123, University Station, Urbana, Ill., Student Member.

Lyttle, Frobisher T., Scarsdale, N. Y., Art Potter, Scarsdale Kilns.

McLaughlin, N. H., Alsey, Ill., Secy., Alsey Brick & Tile Co.

Mathiasen, Alfred, Secretary, Matawan Tile Co., Matawan, N. J.

Millar, Charles A., c/o Ontario Sewer Pipe and Clay Products Co., Toronto, Ont.

Morris, Thomas H., 1104–8th St., Huntington, W. Va., Factory Mgr., The Charles Baldo Glass Co.

Navratiel, Hans, Beuthen/O.-S. Parallelstr. 6, Germany, Ceramic Engineer.

Porter, J. Barton, 1527 Spruce St., Philadelphia, Pa., Engineer, General Electric Co.

Putnam, LeRoy Edward, 1032 So. Grove St., Irvington, N. J., Sales Engineer, Celite Products Co.

Robertson, H. M., 600 Century Bldg., Cleveland, Ohio, Engineer, Robertson-Pease Co.

Seeley, Wm. E., 728 Crocker St., Los Angeles, Calif., Supt., Columbia Glass Co.

Spangler, C. P., 1514 Denniston Ave., Pittsburgh, Pa., Industrial Engineer, James Laughlin Steel Corp.

Tailby, Roland V., 224 Graham St., Highland Park, N. J., Ceramist, Matawan Tile Co.

Thompson, Franklin S., Sayerville, N. J., Ceramist, Sayer and Fisher Co.

Weiser, Franklin S., 45 Prospect St., Waterbury, Conn., Research Engineer, Scovill Mfg. Co.

Whitford, Alfred W., Watsontown, Pa., Ceramic Engineer, Fiske & Co., Inc.

Williams, J. C., 1300 Pennsylvania Ave., N. W., Washington, D. C., Manager, Development Service, Southern Railway Co.

Windolph, Frank S., 1509 N. Frazier St., Philadelphia, Pa., Secy., Chambers Bros. Co., Manufacturers of Brick-making Machinery.

Woodside, Frank C., 100 Northumberland Road, Pittsfield, Mass., Supt., Pittsfield Works, Porcelain Plant, General Electric Co.

CORPORATIONS

Bradford Brick & Tile Co., Face Brick, Hollow Tile, Bradford, Pa., W. L. Hanley, Jr.

J. W. Cruikshank Engineering Co., Glass Factory Engineers, 230 Fifth Ave., Pittsburgh, Pa.

The Detroit Vapor Stove Co., Mfrs. of Stoves, Detroit, Mich., Alvin G. Sherman, Genl. Mgr.

Geist Mfg. Co., Mfgs. and Sales, Fuel Oil Burners, 2001 Atlantic Ave., Atlantic City, N. J.

Hazleton Brick Co., Manufacturing Bricks, 211 Markle Bank Bldg., Hazleton, Pa., Mr. Friedlander, Pres.

Humphreys Mfg. Co., Manufacturers, Sanitary Enameled Iron Ware, Mansfield, Ohio., Frank B. Mahoney.

McLanahan-Watkins Co., Mining and Milling Cyanite, Charlotte Court House, Va.

Milton Pressed Brick Co., Face Brick Mfrs., Milton, Ont., F. R. McCannell, Vice-Pres.

PERSONAL NOTES OF MEMBERS

John L. Carruthers is at present in Los Angeles, Calif., where he is installing a kiln at the Los Angeles Pressed Brick Co. Mr. Carruthers' address is 419 Majestic Bldg., Columbus, Ohio.

Albert S. Adcock is living at 1999 Iuka Ave., Columbus, Ohio.

Harry Barkby, formerly of Wheeling, W. Va., is now situated at 466 Nishannock Ave., New Castle, Pa.

E. N. Bunting, who for a number of years has been instructor in ceramics at the University of Illinois, has taken a position with the Western Electric Co., 463 West St., New York City.

H. T. Bush, formerly of Toronto, is living at Inglebush, Port Hope, Ontario, Canada.

S. F. Cox writes that his address has been changed from 1011 Coal St., Wilkinsburg, Pa. to Box 320, Brackenridge, Pa.

Thomas Stanley Curtis, President of the Vitrefrax Company, lives at 583 So. Templeton St., Huntington Park, Calif.

M. R. Cuthbertson gives as his new address Box 131, Ancon, Canal Zone, Panama. Mr. Cuthbertson formerly was located at Oroya, Peru, S. A.

J. H. Eccles requests that his correspondence be addressed 32 Broughton Ave., Montreal West, Quebec.

The name of **The Ohio Pottery Company** recently has been changed to the **Fraunfelter China Company.**

Park Hitchens, whose name was listed among the "unknowns" in February, is employed by the General Refractories Company at Philadelphia, Pa.

William Gardner, formerly of Ontario, Canada, is now situated with the Cleveland Feldspar Co., 10220 Michigan Ave., Cleveland, Ohio.

James R. Goodwin, formerly of East Liverpool, Ohio, is now situated with the Mt. Clemens Pottery Co. and is living at Ashcraft Apts., No. 4, Little Road, R. F. D. No. 1, Mt. Clemens, Mich.

G. M. Grady gives 24 W. Frambes St., Columbus, Ohio as his correct address.

Carl B. Harrop has moved his office from S. Third St. to 419 Majestic Bldg., Columbus, Ohio. Associated with him are C. D. Bossert, Frank M. Hartford, W. E. Cramer and J. L. Carruthers.

Dr. Havas has moved from Heidelberg to Magyarovar, Hungaria.

Wynne L. Jackson has moved from 111 S. Kilpatrick Ave., Chicago, Illinois, to Central Hotel, Richmond, Calif.

F. M. Koenig is now located at 1005 Lincoln Place, Brooklyn, N. Y.

I. A. Krusen has left Danville, Illinois, where he has been employed with the General Refractories Co. and has gone to Rockmart, Ga. to assist in the reorganization of a fire brick company. Mr. Krusen will act as vice president and general manager of this company.

Thomas N. Kurtz has moved from Hollidaysburg, Pa. to the University Club, Pittsburgh, Pa.

Crawford Madeira has moved from 900 North American Bldg. to the Atlantic Bldg., Philadelphia, Pa.

D. Keith McAfee, formerly of Newcastle, Pa. has moved to 814 N. Seventh St., Cambridge, Ohio..

E. G. Menart has notified the Secretary's office that he has moved from Newark, Ohio, to 506 Fulton Road, N. W., Canton, Ohio.

R. S. Olsen, formerly 501 E. Daniel St., Champaign, Ill., has moved to 5073 N. Lincoln St., Chicago, Ill.

C. R. Peregrine is now general manager of the Marion, Indiana, office of the Macbeth-Evans Glass Company.

Carl Perg has informed the Secretary's office that his correct address is P. O. Box 727, Des Plaines, Illinois.

Richard E. Reif is living at 1004 W. Nevada Ave., Urbana, Ill.

W. D. Richardson has moved from Michigan Ave., to 1473 Belmont Ave., Columbus, Ohio. His business address is 312 Schultz Bldg.

V. J. Roehm has resigned his position as research ceramist for the United States Potters Association, and is holding a similar position with Homer-Laughlin China Co., Newell, W. Va.

Samuel Rusoff, formerly of Anderson, Ind., has moved to 833 Market St., Zanesville, Ohio.

Vincent P. Schildmeyer is living at 96 Albert St., St. Bernard, Ohio. Mr. Schildmeyer formerly lived in Cincinnati.

Edward Schramm requests that his mail be sent to the Onondaga Pottery Co., Syracuse, N. Y.

Carl Seiler, of the Roessler and Hasslacher Chemical Company, has moved from 1127 N. Calvert St. to Falls Station, P. O. Box No. 5, Baltimore, Md.

G. T. Stowe is located at 812 Finance Bldg., Cleveland, Ohio.

W. F. Wenning is now living in his new home, 3354 Francisco St., Pittsburgh, Pa.

E. J. Winkleman, a February "unknown," is located at Winkleman Engineering Co., 460 Union Trust Bldg., Pittsburgh, Penna.

Glenn D. Williams, of Worcester, Mass., is living at the Y. M. C. A., Box 607.

Eugenie A. Worman, of Seattle, Wash., has moved to 1630 Boylston St., Parker Apts.

J. W. Wright, formerly of Charleroi, Pa., writes that his address is now Irwin, Illinois, c/o R. W. Flemings.

OFFICERS FOR 1924

R. D. Landrum, President, Box 8, Station D, Cleveland, O.

R. M. Howe, Vice-President, Kier Fire Brick Co., Pittsburgh, Pa.

R. C. Purdy, Secretary, Lord Hall, O. S. U., Columbus, O.

H. B. Henderson, Treasurer, Standard Pyrometric Cones, 1538 N. High St. Columbus, Ohio.

Board of Trustees

A. F. Greaves-Walker, Stevens, Inc., Stevens Pottery, Ga.

F. H. Riddle, Champion Porcelain Co., Detroit, Mich.

Art Division: F. H. Rhead, American Encaustic Tiling Co., Zanesville, Ohio.

Enamel Division: R. R. Danielson, Bureau of Standards, Washington, D. C.

Glass Division: J. C. Hostetter, Corning Glass Works, Corning, N. Y.

Heavy Clay Products Division: C. Forrest Tefft, Fiske & Co., Inc., Watsontown, Pa.

Refractories Division: J. S. McDowell, Harbison-Walker Refractories Co.

Terra Cotta Division: R. L. Clare, Federal Terra Cotta Co., Woodbridge, N. J.

White Ware Division: C. C. Treischel, R. T. Vanderbilt Co., 50 E. 42nd St., New York City.

Divisions

Art: Miss Mary G. Sheerer, Chairman, Newcomb School of Pottery, New Orleans, La.; Miss Margaret K. Cable, Vice-Chairman, Assistant Professor, University of North Dakota, Grand Forks, N. D.; Herbert S. Kirk, Secretary, Universal Sanitary Mfg. Co., New Castle, Pa.

Enamel: R. R. Danielson, Chairman, Bureau of Standards, Washington, D. C.; H. G. Wolfram, Secretary, Bureau of Standards, Washington, D. C.

Glass: G. E. Barton, Chairman, 227 Pine St., Millville, N. J.; A. N. Finn, Secretary, Bureau of Standards, Washington, D. C.

Heavy Clay Products: F. T. Owens, Chairman, Fiske & Co., Inc., Watsontown, Pa.; John D. Martin, Vice-Chairman, Straitsville Impervious Brick Co., New Straitsville, Ohio; Amos P. Potts, Secretary, 118 E. Blaine St., Brazil, Ind.

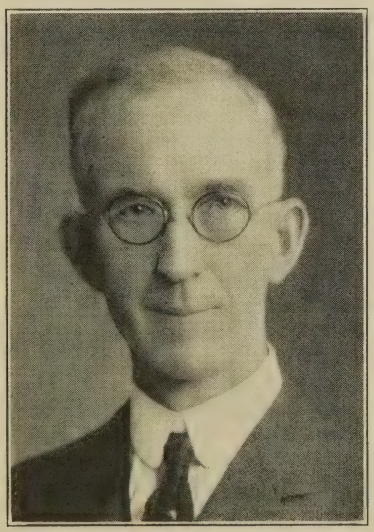
Refractories: Fred A. Harvey, Chairman, U. S. Refractories Corporation, Mt. Union, Pa.; C. E. Bales, Vice-Chairman, Louisville Fire Brick Works, Highland Park, Ky.; R. F. Ferguson, Secretary, Mellon Institute, Pittsburgh, Pa.

Terra Cotta: W. D. Gates, Chairman, American Terra Cotta and Ceramic Co., 1808 Prairie Ave., Chicago, Ill.; B. S. Radcliffe, Secretary, Northwestern Terra Cotta Co., 2525 Clybourne Ave., Chicago, Ill.

White Ware: F. H. Riddle, Chairman, Champion Porcelain Co., Detroit, Mich.; C. C. Treischel, Secretary, R. T. Vanderbilt Co., 50 E. 42nd St., New York, N. Y.

H. B. HENDERSON, TREASURER OF THE AMERICAN CERAMIC SOCIETY

H. B. Henderson, recently elected treasurer of the American Ceramic Society was graduated from Ohio State University with the degree of Bachelor of Science in 1904. For the past eighteen years he has been employed with General Edward Orton



H. B. Henderson

H. G. Wolfram

in the manufacture of pyrometric cones, now serving as superintendent of the Standard Pyrometric Cone Company of Columbus, Ohio. Mr. Henderson has been a member of the Society since 1904 and an active member since 1917. Mr. Henderson has contributed to the *Transactions of the American Ceramic Society* and *Journal*.

H. G. WOLFRAM, NEW SECRETARY OF ENAMEL DIVISION

H. G. Wolfram, born Des Plaines, Illinois, 1896. 1915–1918, employed in enamel shop of Royal Enameling & Mfg. Co. (later Benjamin Electric & Mfg. Co.). 1918–1919, Private, 108 Eng. 33rd Div., A. E. F. Entered the University of Illinois, 1919,

and graduated with B. S. Degree in Ceramic Engineering, 1923. Since that time has been connected with the Enameled Metal Section, U. S. Bureau of Standards, Washington, D. C. Recently elected Secretary of the Enamel Division of the SOCIETY. Has contributed one article to the *Journal.*

TO EDIT REFRACTORIES QUESTION BOX

E. E. Ayars was born in Little Genesee, N. Y., 1894. Graduated from Alfred University, 1917, B.S. degree in Ceramic Engineering. Employed by American Refractories Co., Baltimore, 1917; U. S. Fuel Administration, Washington, D. C., 1918; Asst. Supt. American Refractories Co., Baltimore, 1919 and 1920; Supt., Danville, Ill., 1921, Devils Lake, Wis., 1922, Joliet, Ill., 1922–23. Mr. Ayars was engaged February 1st by the El Paso Brick Co., El Paso, Texas, to develop a fire brick from local refractory clays. Associate member AMERICAN CERAMIC SOCIETY, 1916. Active member, 1921. Chairman, Program Committee, Refractories, 1922, and Chairman Refractories Division, 1923. Editor of Refractories Question Box in the *Bulletin*, 1924. Contributed frequently to SOCIETY publications.

ERLING E. AYARS

C. C. TREISCHEL GOES TO R. T. VANDERBILT COMPANY

The Pottery Department of the R. T. Vanderbilt Company, which is in charge of Ira E. Sproat, announce that they have secured the services of Chester C. Treischel of the General Electric Company Potteries at Schenectady, N. Y. and Pittsfield, Mass., effective March 1.

Mr. Treischel is a graduate in Ceramic Engineering of the University of Illinois, and for the past six years has been associated with the General Electric Company. He is a well-known Ceramic Engineer, having been Secretary of the White Wares Division of the AMERICAN CERAMIC SOCIETY for the past three years and at the annual meeting of the SOCIETY in Atlantic City he was elected a Trustee of the SOCIETY.

NOTES AND NEWS

CERAMIC EXPERIMENT STATION NEWS

P. D. Helser Accepts Appointment

Perry D. Helser has resigned his position as ceramic engineer with the A. C. Spark Plug Company of Flint, Mich., in which capacity he served for five years, to accept appointment to a similar position with the Department of the Interior, Bureau of Mines, Ceramic Experiment Station at Columbus, Ohio effective February 1, 1924.

Mr. Helser enters the service of the Bureau especially well equipped to supervise several of the problems now under investigation both at the Columbus station and in the field.

Utilization of Mineral Cyanite

There has recently been a coöperative agreement entered into with the Department of the Interior relative to the utilization of the mineral cyanite in the manufacture of refractory materials as well as in porcelain. This investigation will be conducted at the Bureau of Mines, Ceramic Experiment Station, Columbus, Ohio.

The mineral cyanite like andalusite, which is being successfully used in the ceramic industry, has the same composition as sillimanite but differs from it in mineral formation. The merits of the mineral sillimanite as a desirable ingredient in ceramic products are fairly well known. The resulting mineral formations if produced under the proper firing conditions, impart to the ware the properties of unusual resistance to sudden temperature changes, exceptionally high mechanical strength and greatly increased electrical insulation, at both normal and elevated temperatures.

When used in special refractories composed almost entirely of sillimanite, as far as some recent investigations have progressed, the results would indicate that such refractories will be well suited for use in the metallurgical field because of the high resistance to sudden temperature changes, the ability to stand up under load at elevated temperatures and because of the neutral nature of the material.

Ohio and Kentucky Fire Clays to be Investigated

The U. S. Bureau of Mines upon request of the Refractories Manufacturers Association has agreed to make a survey of the burning conditions at plants manufacturing fire clay refractories in the Ohio and Kentucky field. The survey will be carried out under the direction of the superintendent of the Ceramic Experiment Station in coöperation with the Fuel Section of the Bureau and will include approximately twenty plants.

CERAMICS SHORT COURSE, UNIVERSITY OF ILLINOIS

The ceramic department of the University of Illinois, under the direction of C. W. Parmelee, professor of ceramic engineering and head of the department, conducted a successful short course in clay working and enameling, January 14–25, 1924. Prof. Parmelee was assisted by the following lecturers and instructors from the University of Illinois:

M. S. Ketchum, Dean of the College of Engineering and Director of the Engineering Experiment Station.

S. W. Parr, Professor of Applied Chemistry.

Morgan Brooks, Professor of Electrical Engineering.

E. B. Paine, Professor of Electrical Engineering.

O. A. Harker, Professor of Law.

E. W. Lehmann, Professor of Farm Mechanics.

B. W. Benedict, Manager of the Machine Shop Laboratories.

A. P. Kratz, Research Professor of Mechanical Engineering.

A. M. Buswell, Chief, Illinois State Water Survey.

R. K. Hursh, Associate Professor of Ceramic Engineering.

A. E. Drucker, Assistant Professor of Mining Engineering.

F. M. Porter, Assistant Professor of General Engineering Drawing.

F. E. Richart, Research Assistant Professor of Theoretical and Applied Mechanics.
E. N. Bunting, Research Associate in Ceramic Engineering.
C. H. Casberg, Superintendent of the Machine Shop Laboratory.
T. N. McVay, Instructor in Ceramic Engineering.
R. T. Watkins, Assistant in Ceramic Engineering.
E. G. Bourne, Laboratory Demonstrator in Ceramic Engineering.

Visiting Lecturers were:

R. R. Danielson, U. S. Bureau of Standards, Washington, D. C.
R. M. Howe, The Kier Fire Brick Company, Pittsburgh, Pa.
A. S. Watts, Head of the Department of Ceramic Engineering, Ohio State University.

Lectures were given on the following subjects:

1. Origin and Properties of Clays. (Eight lectures.) Prof. Parmelee.
2. Elementary Physics and Chemistry. (Twelve lectures.) Dr. Bunting.
3. Explosives and Blasting. (One lecture, illustrated.) Prof. Drucker.
4. Business Law. (Two lectures.) Prof. Harker.
5. The Composition and Properties of Coal. (One lecture.) Prof. Park.
6. Steam Engines and Boilers. (Two lectures, illustrated.) Prof. Kratz.
7. Boiler Water. (One lecture, illustrated.) Prof. Buswell.
8. Dynamos and Motors. (Two lectures.) Prof. Paine.
9. Drying. (Four lectures.) Prof. Hursh.
10. Burning. (Four lectures.) Prof. Hursh.
11. The Use of Clay Products on the Farm. (One lecture.) Prof. Lehmann.
12. Maximum Production from Equipment. (One lecture.) Mr. Benedict.
13. Pyrometers. (Two lectures.) Mr. McVay.
14. Glazes. (Six lectures.) Prof. Parmelee.
15. Prospecting and Sampling. (One lecture.) Mr. McVay.
16. Periodic Kilns. (Two lectures.) Prof. Hursh.
17. Continuous Kilns. (One lecture.) Prof. Hursh.
18. Car Tunnel Kilns. (One lecture.) Prof. Hursh.
19. Care and Maintenance of Machinery. (One lecture, illustrated.) Mr. Casberg.
20. Physical Tests of Clay Products. (One lecture.) Prof. Richart.
21. Winning of Clays. (Two lectures.) Mr. McVay.
22. The Reading of Drawings. (Two lectures.) Prof. Porter.
23. Clay Haulage. (Two lectures.) Mr. McVay.
24. Lighting of Factories and Showrooms. (Two lectures.) Prof. Brooks.
25. Burning Brick for Color. (Two lectures.) Mr. McVay.
26. Fuel Economy. (One lecture.) Prof. Hursh.
27. Plant Problems. Prof. Hursh.
28. Dies and Auger Machines. (Two lectures.) Prof. Hursh.
29. Refractory Materials. (Four lectures.) Mr. Howe.
30. Vitreous Enamels. (Six lectures.) Mr. Danielson.
31. Bodies. (Four lectures.) Prof. Watts.
32. Grinding. (One lecture.) Mr. McVay.
33. Screenings. (One lecture.) Mr. McVay.

A very pleasant feature of the Short Course was a dinner tendered by those attending to the staff of lecturers. This dinner was presided over by Walter P. Wood of the Best Brick Company, Evansville, Indiana, who also arranged a very clever parody in which various members of the Short Course showed the staff of lecturers some of their

foibles. This impromptu entertainment was very amusing and demonstrated that there was a good deal of talent among the group which had not been previously suspected.

Those who registered for this course were:

ALABAMA:

Geo. R. Houston, Birmingham Clay Products Co., Birmingham, Ala.
Ladd, T. E., Southern Refractories Co., Fort Payne, Ala.
Staley, E. L., Sheffield Brick Co., Sheffield Ala.

COLORADO:

LeRoy, Marz, Denver Terra Cotta Co. (Western Plant of the Northwestern Terra Cotta Co.), Denver, Colo.

CALIFORNIA:

Lacy, Roy, Pacific Clay Products Co., Los Angeles, Calif.
Sauters, T. E., Pacific Clay Products Co., Los Angeles, Calif.

ILLINOIS:

Sir, Walter, Chicago Pottery Co., 1924 Clybourne Ave., Chicago.
Cerny, J. J., Northwestern Terra Cotta Co., Cicero, Illinois.
Cruikshank, P. H., Mueller Mfg. Co., Decatur.
Hinman, R. B., Editorial Dept., Ceramic Industry, 407 So. Dearborn, Chicago.
Manley, Rowland Peoples Gas Light and Coke Co., Room 325, 122 So. Michigan Ave., Chicago.
Pegram, Jas., Jr., Carrollton, Illinois.
Starck, John A., Fulton Clay Pipe Factory, Fulton, Ill.
Wilcox, Geo. L., John Wilcox and Sons, McLean, Illinois.
Woare, Edw. M., Decatur Brick Mfg. Co., Decatur.
Wright, Everett, L., Decatur Brick Mfg. Co., Decatur.
Kamm, R. J., Highland Brick and Tile Co., Highland, Ill.
Roefer, C. M., Elgin, Illinois.
Babtist, Hugo, Springfield Paving Brick Co., Springfield, Ill.
Moose, J. E., Chemistry Department, University of Illinois.
Gaskin, T. D., Midland Terra Cotta Co., Chicago.
Carter, R. F., Peoria Brick and Tile Co., Peoria, Illinois.
Gauthier, Chas. B., 107 Blooming Bank Rd., Riverside, Illinois. (Research Engr., Western Electric Co.).

INDIANA:

Casey, J. B., Colfax Drain Tile Co., Crawfordsville, Ind.
Landers, Wm. F., Jr., United States Encaustic Tile Works, Indianapolis.
Wood, Walter, P., Best Brick Co., Evansville, Ind.

MISSOURI:

Guenther, William, Bridge and Beach Mfg. Co., St. Louis, Mo.
Bradley, R. S., A. P. Green Fire Brick Co., Mexico, Mo.
McCann, F. A., A. P. Green Fire Brick Co., Mexico, Mo.

OHIO:

Cornelius, V. R., Metropolitan Paving Brick Co., Canton, O.
McCallin, P. J., Metropolitan Paving Brick Co., Canton, O.
Yohe, L. C., Metropolitan Paving Brick Co., Canton, O.
Emig, W. R., Toledo Scale Co., Toledo, Ohio.

Lynn, Horace K., Summitville Face Brick Co., Summitville, O.
McNeil, Daniel W., The John Douglas Co., Cincinnati.
Schildmeyer, Vincent P., The Cincinnati Porcelain Co., Cincinnati, O.
Vormelker, Howard I., National Lamp Works of General Electric Co., East Cleveland, Ohio.
Ketchem, Edw. R., Estate Stove Co., Hamilton, O.
Dimmick, R. B., United Alloy Steel Corporation, Canton, O.

PENNSYLVANIA:

Clowes, Edwin A., McCullough-Dalzell Crucible Co., Pittsburgh.
Drummond, C. R., Fiske and Co., No. 5 Plant, Watsontown, Pa.
Seanor, J. G., Darlington Clay Products Co., Darlington, Pa.

TENNESSEE:

Harker, O. A., Jr., Dixie Brick and Tile Co., Puryear, Tenn.
Jackson, Walter H., Dixie Brick and Tile Co., Puryear, Tenn.
Murphy, Wayne F., Tennessee Enamel Mfg. Co., West Nashville, Tenn.

TEXAS:

Elders, Jno. A., Acme Brick Co., Millsap, Texas.
Kelly, J. W., Acme Brick Co., Denton, Texas.

KENTUCKY:

McDonald, P. C., Coral Ridge Clay Products Co., Louisville, Ky.

WISCONSIN:

Held, Henry J., Rundle Mfg. Co., Milwaukee, Wis.

IOWA CLAY PRODUCTS MANUFACTURERS

Convention and Short Course at Iowa State College

The members of the Iowa Clay Manufacturers Association met at Iowa State College for their Annual Convention and Short Course, February 14 and 15, 1924. The officers of the Association are:

President, Carl A. Reaver, Eldora Pipe and Tile Co., Eldora, Iowa.
Vice-President, W. A. Queale, Redfield Brick and Tile Co., Redfield, Iowa.
Treasurer, H. R. Straight, Adel Clay Products Co., Adel, Iowa.
Secretary, M. T. Straight, Adel Clay Products Co., Adel, Iowa.

The following program was presented during the two days convention and course of instruction. At the banquet which was held for the guests, each one was given a small matt glazed bowl of good workmanship and commercially perfect in quality, made from Iowa raw materials. These were presented by the Department of Ceramic Engineering, Iowa State College.

Program

1. Depreciation as a Factor in Production Cost, Dean Anson Marston, Iowa State College, Ames, Iowa.
2. Load-O-Grams, Starr E. Cogswell, Western Weighing and Inspection Bureau, Des Moines, Iowa.
3. Drain Tile Specifications and Testing, W. J. Schlick, Drainage Engr., Iowa State College, Ames, Iowa.

The Future of the Railroad Tunnel Kiln, H. R. Straight, Gen. Mgr., Adel Clay Products Co., Adel, Iowa.

5. Labor Saving Machinery, C. A. Thorp, Mechanical and Ceramic Engr., Des Moines, Iowa.
6. National Advertising Reflected in Economic Conditions, J. C. De Lay, Creston, Iowa.
7. Washing Iowa Coals, Prof. D. A. Moulton, Iowa State College, Ames, Iowa.
8. Selling Clay Products to the Building Material Dealer, C. B. Platt, Editor Permanent Construction, Des Moines, Iowa.
9. Simplification and Research, J. S. Sleeper, Hollow Tile Assn., Chicago, Ill.
10. Plant Operation, O. J. Whittemore, Sheffield Brick and Tile Co., Sheffield, Iowa.
11. Uses of Clay Products in Building Structures, Prof. A. H. Kimball, Iowa State College, Ames, Iowa.
12. The Outlook Ahead, John P. Wallace, Wallace's Farmer, Des Moines, Iowa.
13. Accounting Cost Control of Clay Products Plants, F. A. Guignon, Brick and Clay Record, Chicago, Ill.
14. Letters that Pull, Prof. A. Starbuck, Iowa State College, Ames, Iowa

Those attending the meeting were:

Alt, Leslie R., Sioux City Brick & Tile Co., Sioux City, Iowa
Bacon, E. C., Hollow Bldg. Tile Assn., Omaha, Nebraska
Barret, Wayne E., Adel Clay Products Co., Adel, Iowa
Bradshaw, E. P., Bradshaws Co., Fort Dodge, Iowa
Bristol, C. J., Globe Machinery Co., Des Moines, Iowa
Bucht, C. J., Boone Brick & Tile Co., Boone, Iowa
Carhart, F. F., Jackson Tile & Brick Co., Des Moines, Iowa
Chamber, J. T., Fate-Root-Heath Co., Plymouth, Ohio
Cogswell, Starr E., Western Weigh. and Inspection Bureau, Des Moines, Iowa
Cox, Paul E., Iowa State College, Ames, Iowa
Furman, M. C., Des Moines Brick & Tile Co., Des Moines, Iowa
Furness, J. H., Sheffield Brick & Tile Co., Sheffield, Iowa
Galvin, G. H., Rockford Brick & Tile Co., Rockford, Iowa
Green, John R., Northern Iowa Brick & Tile Co., Mason City, Iowa
Guignon, F. A., Brick & Clay Record, Chicago, Illinois
Irwin, W. J., Vincent Clay Products Co., Fort Dodge, Iowa
Jackson, W. L., Buckey Clay Products Co., Belle Plaine, Iowa
Johnson, S. C., Kalo Brick & Tile Co., Otho, Iowa
Love, J. P., Boone Brick & Tile Co., Boone, Iowa
McHose, Ray M., Nevada Brick & Tile Works, Nevada, Iowa
Martin, S. A., Centerville Brick Co., Centerville, Ia.
Miller, R. L., Green Tile & Brick Co., Cedar Rapids, Iowa
Neiswanzer, C. O., Standard Clay Products Co., Oskaloosa, Iowa
Page, D. C., Walter Bledsoe Co., Chicago, Illinois
Parks, J. G., Morey Clay Products Co., Ottumwa, Iowa
Pearse, F. D., National Clay Works, Mason City, Iowa
Platt, C. B., Platt Company, Des Moines, Iowa
Queale, W. A., Redfield Brick & Tile Co., Redfield, Iowa
Rawson, Cummins, Iowa Pipe and Tile Co., Des Moines, Iowa
Reaver, C. A., Eldora Pipe and Tile Co., Eldora, Iowa
Selby, Ralph L., Reliance Brick Co., Des Moines, Iowa
Schurr, Wm., Kalo Brick & Tile Co., Fort Dodge, Iowa
Sleeper, J. S., Hollow Bldg. Tile Assn., Chicago, Ill.

Souder, W. J., Des Moines Clay Co., Des Moines, Iowa
Straight, H. R., Adel Clay Products Co., Adel, Iowa
Straight, M. L., Adel Clay Products Co., Adel, Iowa
Strouse, H. S., Pawling & Harnischfeger Co., Milwaukee, Wisconsin
Tallman, J. L., Thew Shovel Co., Kansas City, Missouri
Taylor, Mark A., Vincent Clay Products Co., Fort Dodge, Iowa
Tearson, H. C., Maxwell, Iowa
Thorpe, Clyde A., Des Moines, Iowa
Tolbert, Geo. M., Iowa Pipe & Tile Co., Des Moines, Iowa
Tramp, H. L., Creston Brick & Tile Co., Creston, Iowa
Treble, Herbert, Natl. Clay Products Association, Chicago, Illinois
Tungate, Chas. M., Iowa Mach. and Supply Co., Des Moines, Iowa
Tulla, Ralph W., Reliance Brick Co., Des Moines, Iowa
Vincent, Harry, Vincent Clay Products Co., Fort Dodge, Iowa
Watkins, M. M., Brown Instrument Co., Chicago, Illinois
Wells, F. G., Maxwell, Iowa
Wheaton, J. J., Sheffield Brick & Tile Co., Sheffield, Iowa
Witel, John, Toledo Brick & Tile Co., Toledo, Iowa
Zook, Samuel I., Des Moines Clay Products Co., Des Moines, Iowa

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CALENDAR OF CONVENTIONS[1]

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21–Aug. 16, 1924	Trip to Pacific Coast
Am. Foundrymen's Assn.	Oct., 1924	
Am. Gas Assn., Inc.	Oct., 1924	
Am. Iron and Steel Institute	May 23, 1924	New York
Am. Zinc Institute, Inc.	Apr. 28–29, 1924	St. Louis, Mo.
Assn. of Scientific Apparatus Makers of U. S. A.	Apr. 25–26, 1924	Washington, D. C. Bureau of Standards
Chamber of Commerce of the United States	May 6–8, 1924	Cleveland, Ohio
Chemical Equipment Assn.	Sept., 1924	
Eastern Clay Products Assn.	Apr., 1924	
Eastern Paving Brick Mfrs. Assn.	Dec. 9, 1924	New York (?)
Glass Container Assn. of America	Apr. 25, 1924	Atlantic City
Glazed and Fancy Paper Mfrs. Assn.	Week of Apr. 7, 1924	New York
Manufacturing Chemists Assn.	June, 1924	New York
Mirror Mfrs. Assn.	Mar., 1924	Pittsburgh
Natl. Assn. of Brass Mfrs.	Mar. 12–14, 1924	West Baden Springs, Ind.
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	Mar., 1924	Pittsburgh
Natl. Assn. of Mfrs. of the U. S. A.	May 19–21, 1924	New York
Natl. Assn. of Stove Mfrs.	May 14–15, 1924	New York, Hotel Astor

[1] Further information may be secured through the Chamber of Commerce of U. S., Washington, D. C.

Natl. Bottle Mfrs. Assn.	Last Week in Apr., 1924	Atlantic City
Natl. Glass Distributors Assn.	Dec., 1924	Pittsburgh
Natl. Ornamental Glass Mfrs. Assn. of U. S. and Canada	June 24–26, 1924	New York
Natl. Paving Brick Mfrs. Assn.	Dec., 1924	
Penna. Gas. Assn.	April, 1924	Atlantic City
Refractories Mfrs. Assn.	Mar. 19, 1924	St. Louis, Mo. (?)
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	May or June, 1924	
U. S. Potters Assn.	Dec., 1924	Washington, D. C. (?)
Western Glass and Pottery Assn.	June 15, 1924	Pittsburgh
Western Society of Engineers	June 4, 1924	Chicago

ERRATA

Bulletin of the American Ceramic Society, **3** [1], 39 (1924): Under the Biographical Sketch of Karl Turk, "Penn" System should read "Pemco" System.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Mary G. Sheerer, H. S. Kirk — Art
R. R. Danielson, H. G. Wolfram — Enamel
G. E. Barton, A. N. Finn — Glass
F. A. Harvey, R. F. Ferguson — Refractories
F. H. Riddle, C. C. Treischel — White Wares
W. D. Gates, B. S. Radcliffe — Terra Cotta
F. T. Owens, A. P. Potts — Heavy Clay Products

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H. B. Henderson, Treasurer
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R. L. Clare
C. C. Treischel

Vol. 3 — April, 1924 — No. 4

EDITORIALS

A CERAMIC INSTITUTE

Certified testing of materials and products, and opportunity for determining the most economic methods and processes unbiased by competitive interests are the basic reasons for the increasing demand for a Ceramic Institute. Such an Institute would have to be supported directly by the ceramic manufacturers. It is a cold business proposal stripped of altruism.

The benefits would have to be proven in terms of dollars and cents but with appreciation of the value of looking ahead. A program of investigations that did not anticipate the future needs would be shortsighted and not worthwhile. The present needs must be cared for but to limit an Institute program to these would result in a fluttering of purpose and a temporizing in expediences. To be productive, to prove itself by a dollar and cents standard, a Ceramic Institute must be broad as well as sound in its conception and conduct.

Such an Institute should not overlap in purpose or program any of the existing investigational organizations which ceramic manufacturers are supporting and must continue to support through taxation. The waste which would result from duplication of laboratories and personnel as well as in activities must be avoided. The employment to the full of the existing agencies is sound economy of time, money and human effort.

There is now no non-commercial institution engaged in routine ceramic testing. There is no place where materials and problems can be submitted with surety of being investigated. The Federal and State departments want such an institution and the Ceramic Institute properly organized and equipped would fill this want.

There is now no central pooling agency for technical directing of investigational work. This results in duplication and entails the loss of concerted effort. For example it was proposed at one of the sessions of the White Wares Division of the American Ceramic Society to initiate an investigation of the sagger problem and of the standardization of feldspar. The U. S. Potters Association has undertaken these but limited only to their own members without the collaboration of the other ceramic groups which are equally concerned industrially and financially. The American Ceramic Society has not organized to raise funds and to prosecute investigations. It should and does concern itself, however, with finding ways and means of obtaining the fullest possible collaboration in investigations of direct interest to more than one group. This is the reason for its possible interest in a Ceramic Institute.

The success of the joint investigation of kiln fuel economies by the four Heavy Clay Associations shows the value of the several ceramic associations pooling their technical investigations through an institute.

The Mellon Institute, the Federal Bureaus and the Universities offer opportunities for much of this desired collaboration. The services they are rendering should not be duplicated. A more intimate contact of these agencies with the industries should be obtained. The Institute with which this editorial deals would manifold and make more intimate these contacts without in the least decreasing the control over the investigations undertaken and the reports rendered. This Ceramic Institute would provide means for the Universities making similar contacts through fellowships and participation in general investigation programs.

The trade associations should be engaged in technical research of their production problems and in standardization of their product. Promotional sales engineering requires technical research on materials and products, and competition necessitates the highest quality at the lowest cost. That these desiderata are appreciated by ceramic trade associations is shown by the investigations they already are financing in coöperation with the several laboratories and by the proposal by the Common Brick Association of founding a Ceramic Institute.

The Ceramic Institute could be a chartered organization with a directorate elected by the association members. It could employ a Technical Director for full time service and a small staff of part and full time routine laboratory assistants. The Institute would determine the available laboratory and personnel facilities and place with each laboratory the

investigation which it is best fitted to conduct. After placing the investigation, the contact between the financing group and the laboratories would be as direct as it could now possibly be, the Institute through its Technical Director acting in a consultant capacity.

The Ceramic Institute should coördinate its organization and work with that of the AMERICAN CERAMIC SOCIETY using the SOCIETY'S organization for collaborating in research, compilation of data, preparation of standards, investigation of methods, contacting with other investigational societies and institutions; and especially should the Institute employ the editorial, abstracting and bibliography service rendered by the SOCIETY.

The AMERICAN CERAMIC SOCIETY is devoted to promoting the technical welfare of the ceramic industries. It is organized especially for this limited service. In contrast, the trade associations are organized for the promotion of the trade interests of their firm members. It has been the realization of need of technical research in production problems that trade associations have engaged in coöperation with the Federal and institutional laboratories. The SOCIETY was not organized to undertake the financing of investigations. Its function has been to interest trade associations in undertaking technical research of their production problems and the purpose of this editorial is to show that the interested groups can go one step further and coördinate these investigations through a Ceramic Institute without loss of contact and proprietary rights and privileges. This Institute would thus serve a purpose for which no existing organization is qualified to undertake and which would not duplicate, conflict nor alter the present organizations and schemes of coöperation. It would serve as a coördinating agency in ceramic research, reduce duplication, secure collaboration of all groups interested in a given problem and effect economies from these and the several other items of wastage that come from lack of a coördinated program. And not the least important, it would command universal respect for the findings approved by the Ceramic Institute and provide a unit source of information and action.

The AMERICAN CERAMIC SOCIETY would fall short in its obligations to the ceramic industries if it failed to adapt itself to this new scheme of coördinated research.

HAS THE SOCIETY BENEFITED POTTERS?

A prominent pottery owner has expressed regrets that the SOCIETY is not of more benefit to the potters. This criticism, expressed in confidence and without the withdrawal of his corporation and personal membership, is taken as a friendly challenge which the SOCIETY meets frankly and fearlessly. If one, who for years has been and now is a loyal supporter

would question the value of the SOCIETY, surely those potters who have not affiliated and made use of the SOCIETY have no reason for investing in it.

If the benefit of the SOCIETY to potters is not evident, the cause is either that the potters have not been receptive and aware of the agencies through which information has been made available or the SOCIETY is not functioning correctly and making known its activities. We can hold no brief for either the "doubting potter," or the SOCIETY. As it is now constituted and operated, for our concern it gives effective service.

Surely there can be no questioning of the benefits which are possible from a collaboration of ceramists in the searching and recording of information. This is a coöperative research. It is an orderly acquisition of information, an exchanging of the bit which one has found for the total sum recorded by others. It is a coöperative abstracting and recording of the printed records from the world's literature. It is making available to all ceramic industries the things of common interest in each of them.

If there is any value in being informed, surely there is value in this broad coöperative exchanging of information. No one person could possibly accomplish what the members of the SOCIETY collectively are doing. No journal or institution of limited personnel and limited industrial contact could be as effective. No single industrial group working alone could be as broad and thorough. A SOCIETY of ceramists representing all of the ceramic industries is essential to the most effective and the most productive obtaining and proving of that knowledge by which and only by which progress is possible.

It is significant that following the example set by the AMERICAN CERAMIC SOCIETY similar societies have been organized in six other countries. It is significant also that the industries which have enjoyed the greatest progress have engaged most intimately in this same sort of collective searching for knowledge.

The rapid progress made in "potting" in America is creditable to no small extent to the fact that there has been a SOCIETY devoted exclusively and intensively to the finding and proving of scientific facts. This can be proved in specific cases and processes. Such lack of evidence of truth as there may be in this assertion lies in the fact that recorded information is of no value to any individual until it is adapted by him and applied. Differences in ability, and resourcefulness in finding and using facts is a measure of the difference in value to each participant of this organized collecting, abstracting, classifying and proving of specific facts.

There are those like Josiah Wedgewood, to whom it is natural to search for and apply knowledge. He demonstrated that, without school training, and without benefit of trade papers, and without the inspiration and help of organized collaboration of his fellows it is possible to make wonderful

progress. He sought and obtained information and assistance. Like Bell of the telephone, Wedgewood recognized the applicability of various bits of knowledge. It is the ability to sense facts and to make application that distinguishes those who have been the world's greatest inventors and industrialists. This ability will express itself in spite of such handicaps as lack of scientific collaboration.

There are those who obtain very little benefit from school training or from collective research with his fellows. They do not have the capacity to find, to recognize and to use information. But both those most proficient and those least adept in finding and using facts will profit from collaboration with his fellows. If the activities of the American Ceramic Society have benefited one potter more than another it must be due to the differences in their capacity to recognize and to apply information.

To be consistent in the denial of benefits from the activities of the Society, one must deny the benefits accruing from ceramic schools, and from the ceramic divisions of the federal bureaus, for which the Society was directly responsible. To deny these benefits is to deny that progress has been made in manufacturing and in maintenance of quality.

Several potters are participating with profit in the work of the 500 members of the Whiteware Division. They do not question the value to them of its present and potential service. The American Ceramic Society in general and the Whiteware Division in particular has been and continues to be in form of organization and in activities, very responsive to the most urging demands made on it.

PAPERS AND DISCUSSIONS

THE MEANING OF "KERAMOS" ONCE MORE

By W. A. Oldfather

In the *Keramische Rundschau*, **31** [1–3], 1–2 (1923) (in large part a clear presentation by O. Rasser of present technical usage in Germany), 11–12; 21–2, under the caption "Was versteht man unter Keramik?" Herman Hecht has submitted the[1] "Report of the Committee on Definition of the Term 'Ceramics,' " to a detailed criticism in which he expresses dissent from most of the recommendations of that Committee. At the request of the Editor of this *Journal* I shall reconsider some aspects of the question, because in one very important detail our knowledge of the subject has progressed since the report was made in 1920. Upon the few technical points about processes of manufacture, and the suggestion[2] that a better comprehensive designation would be "Silicate Chemistry," I have, of course, no opinion to express.

Dr. Hecht raises objection to the contention[3] that an established usage offers a measure of justification for the extension of the original meaning of a word, and asks (p. 12), "where and when has the technical world united clay products and glassware under the single designation 'Ceramics?' " (Cf. p. 21.) The answer is United States for some years past, and the substantial evidence for that statement is given on pp. 526–7 of the "Report;" to which we may now also add the twenty countries represented at the Fourth International Conference of Chemistry held at Cambridge, England, June 17–20, 1923.[4] Indeed, one is tempted to go even further, and on the strength of the argument from "the range of material which one finds presented to their readers by the American publications in this field,"[5] to suggest that even in Germany itself, where the need for such a comprehensive designation has brought forth the suggestion "Stone and Earth Products" (*Steine und Erden*), there seems already to be developing a use for the word *keramik* and *keramische* which closely approximates what was until recently the characteristically American one. The *Keramische Rundschau* itself, as a mere glance at its contents will show, contains articles, news, reports, and advertisements of glass manufacture (generally indeed under a separate heading from "Keramik" and "Email") in full measure, obviously as a part of its special field. Not only that, but its full official title confirms this preliminary inference:

[1] *Jour. Amer. Ceram. Soc.*, **3** [7], 526–42 (1920).

[2] *Keram. Rund.*, p. 22.

[3] "Report," p. 542.

[4] (See *Compte Rendu Analytique de la Quatrième Conférence Internationale de la Chimie*, Paris, **1923**, pp. 9, 10, 12.)

[5] "Report," p. 527.

"Keramische Rundschau. Fachzeitschrift für die Porzellan-, Steinzeug-Steingut-, Töpfer-, Glas-, und Email- Industrie." It would seem almost naïve to raise the question, "Where is 'Ceramics' used to include the glass industry?" in discussing a report the very second paragraph of which gives a detailed answer, and in the pages of a journal whose very title is an illustration of the tendency in point.

An important phase of the argument from Greek usage was the contention "that *keramos* and derived forms were not clearly felt by the Greeks to designate the material *per se* (as we speak of 'earthenware')." This was supported by a series of citations from Homer to St. Chrysostom, in which the designations golden, silver, bronze, marble, stone and lead were applied to the word and its derivatives.[1] Dr. Hecht[2] advances now the interesting view that the Greek potters may have called some wares gold, bronze, or silver *keramos* because of the particular color of the glaze. The only fact adduced in support is the occasional use of tiny patches of gilt on a few late vases, but even here there exists nothing that by any stretch even of fancy could be called as a whole "gold keramos," whereas there is no trace in literature or monuments of any silver or bronze *keramos* of the kind postulated, to say nothing of marble, stone, or lead *keramos* (or *keramis*). It is perfectly clear that in the passages cited we do not have to do with earthenware of any kind, but actual metal or stone in the shape of articles that were ordinarily made of earthenware. For example, an earthenware jar with a purely hypothetical bronze glaze, to justify Homer in speaking of a "bronze *keramos*," would have been a very flimsy thing in which to keep the redoubtable god of battles, Ares (Mars), for thirteen months a prisoner; and could any one fancy that the notoriously luxurious and extravagant Cleopatra used only earthenware with an again purely hypothetical gold and silver glaze, instead of actual gold and silver plate, as did not only all ancient princes from Homer's time onwards, but even thousands of well-to-do private citizens?

But after all these are minor points. Dr. Hecht lays most stress on the assertion that *keramos*, whatever its etymology, meant normally "clay" in Greek (p. 2, 11–12, 21), calling attention to the fact that I did not absolutely deny the possibility of this meaning,[2] although I had a shrewd suspicion that it was no more justified by usage than by etymology.[3] It

[1] "Report," pp. 539–40.

[2] *Keram. Rund.*, p. 21.

[3] "Report," p. 537: "*keramos*, a general term designating the product (and perhaps also, although apparently later, if at all), the material of the potter's art." *Op. cit.*, p. 539, n.l.: (After rejecting the best examples given by the lexicons for this meaning of the word) "I do not claim that *keramos* never means 'clay,' for, of course, I have not examined all the thousands of instances of the occurrence of this word, and those that are derived from it, but the cases cited by the lexicons for this meaning are not conclusive, and, in any event, that can scarcely have been the primary meaning."—Anyone

is on this point that the general question has advanced somewhat since the "Report" was published. During 1920 and 1921 A. F. Pauli of the University of Illinois worked upon the lexicography of *keramos* and its derivatives, in part under my general supervision, and presented his results in a dissertation in June, 1921 entitled, "Studies in the Vocabulary of Ancient Greek Ceramics: Keramos and its Derivatives." This dissertation, in part recast so as to make its results more generally understandable, will be published soon, it is hoped, and there the proof will be presented in detail for the contention that *keramos* never means "clay," but only "the baked material of earthenware," "earthenware" itself, some special variety of "earthenware," or some other material in the shape of an article that was ordinarily made of "earthenware." The testimony of the lexicons, accordingly, which in Greek is generally incomplete and antiquated, in this case completely collapses before the unanimous verdict of the etymologists, whose work in contrast with that of the lexicographers is scientific, thorough, and up-to-date, and before an exhaustive examination of all the available evidence drawn from the greatest variety of sources. *Keramos* did not, therefore, either originally, or by derived and extended meaning, designate to the Greeks "clay," but rather primarily "earthenware," or, precisely what its etymology requires, "the burnt stuff,"[1] and therefore an adjective derived from it may, when a widespread technical usage has already developed independently, with propriety be applied to any product "in whose manufacture a change of physical and chemical properties under the influence of high temperatures is required"[2] in which, in other words, "burning" is the characteristic feature of production.

University of Illinois
Urbana, Illinois

experienced in lexicographical studies will recognize that in a collection of several score passages containing a term which might be translated by such closely related words as "clay" and "earthenware," there will be a few in which either meaning might make sense. The semantic test is whether there are any passages where a certain meaning is *demanded* in order to make sense. Thus, if in the majority of a large number of sentences *keramos must* mean "earthenware," and with that meaning makes perfectly good sense in all the other instances, while it *never must* mean "clay" but only occasionally *might* mean "clay," where, however, the meaning "earthenware" is just as good, then it is clear that "earthenware" is the only demonstrable meaning for the word.

[1] "Report," p. 539.

[2] "*Ibid.*," p. 540.

FUEL OIL BURNING TO OBTAIN THE HIGHEST TEMPERATURE COMBINED WITH UNIFORM HEAT DISTRIBUTION

By G. Ross

Variants

The many systems of oil burners which exist on the market today make it impossible for Engineers to investigate them individually, and determine which one is most suited to his purpose. In general, burners can be classified as high or low pressure burners, or as burners with a greater or less atomizing effect.

The character of oil used is of first importance, and the results obtained will be widely different between heavy oil, light oil, and all the gradations between these two extremes. The temperature at which oil is fed to the burner is also of great importance.

Objective

It is necessary to combine the above factors in such a way as to produce:

A concentrated long flame
A concentrated short flame
A voluminous long flame
A voluminous short flame

These different flames are used by direct or indirect firing for obtaining

(*a*) A low temperature (500°C)
(*b*) A middle temperature (1000–1200°C)
(*c*) A high temperature (1400–1500°C)

When the desired result is to obtain temperatures up to 1200 degrees by means of direct firing, the matter becomes relatively easy. The object of this discussion is to cover only the most difficult one of the combinations specified, *viz:* to obtain a temperature from 1400° to 1500° and at the same time a uniform distribution of the heat in all parts of large furnaces which are to be heated indirectly.

Discussion

In the case of indirect firing, great resistance is interposed by fire-brick walls or by the walls of a retort to the passage of sufficient calories to secure the high temperature mentioned. For ordinary purposes the best burners are those which give the greatest atomizing of the oil, and the best mixture between oil and air. When this result is secured, the combustion between the two occurs close to the mouth of the burner to secure a long flame with an even distribution of the heat. Such a burner is not suitable for a uniform distribution of heat in a large furnace, using indirect firing and requiring a long flame. Too many calories are developed at the mouth of the burner, resulting in a concentration of heat at that point, and in an impoverishment of the flame beyond that point; which makes it impossible to secure the desired high temperature over the remainder of the furnace. Complete combustion is secured by this atomizing and perfect mixing with air,

but the stream combustion product, has but little more heating value than the gases ordinarily described as waste heat, and with the temperature which resulted from the combustion which just occurred. This temperature is not sufficient to reach 1400° by indirect firing.

One of the most important distinctions between coal firing and firing with oil or cleaned gases, is that in the first case the gases are charged with a multiplicity of particles of ash and unburnt coal. In the second case there are a very few particles of ash or unburnt carbon and the resulting waste heat gases are clear and transparent. The condition of a small number of particles is only true within a short distance of the burner, and the gases at a farther distance have no unburnt particles which can act as a medium for the transportation of the calories. Irrespective of the amount of combustible burnt, the lack of these particles prevents points in the furnace remote from the burners, from reaching the temperature desired. To reach such a temperature some medium is needed for the transportation of the calories from the combustion zone to all the points at which this temperature must be secured.

This is demonstrated by the following experiment:

In a furnace heated by producer gas, from one end, and after reaching the desired temperature throughout the furnace, the gas was closed off, and coke oven gas which had been well cleaned of all mechanically entrained particles, was admitted. The temperature of combustion of this gas was higher than that produced by the producer gas. In spite of this, pyrometric observations taken against the outside and inside of a retort at a distance of one meter from the point where the coke oven gas was admitted, gave the following extraordinary results: As soon as the coke oven gas began to replace the producer gas, the outside temperature of the retort began to fall. The inside temperature remained stationary for some time, and later assumed the same temperature as the outside. This experiment was repeated several times, and it was later found that an excess of coke oven gas had been admitted, and that if this excess were reduced to a minimum, that a certain amount of unburnt carbon resulted, providing a radiant medium, and bringing the temperature back to the same point which was reached by the producer gas. The temperatures involved are approximately 1400° on the outside of the retort, which maintained 1280°C on the inside of the retort. The thickness of the retort wall was 30 mm.

From the above it is apparent that although high atomization and complete air mixing produce highest temperature near the orifice of an oil burner, this combination will not secure the result of uniformly distributing the heat over a large furnace, nor secure the necessary temperature on the inside of a retort. The use of a minimum excess of oil ameliorates to some extent the unfavorable conditions described above. It burns

by slow combustion over the entire distance from the burner to the outlets of the furnace, producing a certain amount of free carbon particles which transport some of the heat from the combustion zone to the more distant parts of the furnace.

This expedient will serve to produce the desired temperature with the ordinary type of burner, but even then the distribution of heat is not uniform over the furnace, being much higher near the burner, and much lower near the waste gas outlets.

To secure this latter result it is necessary that the burner does not atomize the oil, but rather throw it into the furnace in particles comparatively small, but still of sufficient size so that complete combustion does not take place until the entire length of the furnace has been passed. This system of combustion is only possible when the temperature of the furnace is very high (about 1400°), as otherwise rapid and complete combustion would not be secured. Theoretically, the mixture of air and unburnt oil must continue until the most remote parts of fire-brick wall or retorts are reached, in order that these latter points will have a continuous influx of calories. To have the heat distribution uniform and at the correct temperature, the burner must supply sufficient perfect combustion near its orifice and produce the highest temperature desired, and there must be a sufficient excess of unburnt oil and air to transport this temperature to the farthest points of the furnace. These unburnt particles of oil and air, must impinge on the farthest retort and burn at that point to complete combustion. These particles must still be fine enough to assure complete gasification and rapid burning.

Conditions will be greatly dependent on the quality of the oil, and its temperature as it enters the burner. If the oil is too light, it will be too easily volatilized and will be decomposed too soon in high temperatured furnaces before being able to complete the trajectory to the end of the furnace. If the oil is too cold, it will not permit a rapid combustion, nor will the particles produced by the burner be of sufficiently fine size; while at the same time it will prevent the obtaining of the high initial temperature desired near the mouth of the burner.

To secure the conditions desired as outlined, the highest temperature must be developed near the burner mouth, and the stream of unburnt and waste products must carry in suspension sufficient particles of oil and air, so that their gradual combustion will produce heat and carbon particles over the entire distance until each part of the furnace has been reached. The specific gravity of the oil is limited on the one hand by the fact that higher gravity oils will volatilize too quickly; and on the other hand that the heavier oils will form particles so large that they will not burn quickly enough. The correct oil will form particles which will be large enough to last until the remote points of the furnace are reached,

but which at that point will be entirely consumed. These particles, at the same time, act as transmission agents for the excess calories which are produced near the burner and carry them to the more remote points.

It is evident that these heavy particles in the stream of oil and air have a natural tendency to drop to the bottom of the furnace, leaving the stream too poor in hydrocarbons as the farthest end of the furnace is reached. To overcome this factor, it is necessary to give the oil and air a strong mechanical impulse at the burner, which will insure the travel of these particles to the farthest points of the furnace before allowing them to drop.

An important distinction between oil and gas firing is that the number of calories produced from oil or other high calory fuels in a given unit of time is much larger than that produced by producer gas. This necessitates careful designing near the orifice of the burner to provide the correct combustion space that may be required by these different fuels.

The object of this article is to present some phases of this important question to the attention of the different engineers and metallurgists who have experimented along these lines, and to invite their discussion.

Metallurgical Engineer
General Manager, Saltillo, Mexico

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

I. What effect does 2% or more of titanium oxide have on fire-clay refractories?

Discussion It lowers the fusion point slightly. A value of $^1/_2$ cone per 1 % has been suggested when the clay has a composition similar to that of kaolinite. However, most fire clays contain 2% of titania, the amount present usually varying with their alumina content. This is a fortunate condition as the more aluminous clays are better able to carry the additional burden. Generally speaking the better clays high in silica carry about 1%, the "normal" clays about 2%, and the highly aluminous clays 3%. It is quite probable that the fluxing power of titania is less than $^1/_2$ cone per 1% when present in the small amounts found in fire clay—a rough value of $^1/_4$ cone per 1% might be more appropriate. It is difficult to lay down an iron clad rule because of the different forms in which it may be present and the other characteristics of the clay.—Raymond M. Howe, Kier Fire Brick Co., Pittsburgh, Pa.

The following discussion is taken from "British Clays, Shales and Sands."—A. B. Searle.

Titanium compounds occur more frequently in clays than is commonly supposed, though only in small quantities (under 2% TiO_2) and in the ordi-

nary methods of analysis it is included in the figures for alumina. Titanium compounds occur chiefly as rutile (TiO_2), ilmenite ($TiFeO_3$) and titanite ($CaTiO_5$) and act as somewhat powerful fluxes; hence clays which are required to be highly refractory should not contain more than 2%. Several investigators have independently examined the effects of titanium oxide on china clay and on artificial mixtures of alumina and silica. Their results show that within the limits in which this substance usually occurs in clays, the reduction in refractoriness is less than 40°C and is therefore negligible if less than 2% of titanium oxide is present. Ten per cent of this oxide lowers the softening point of kaolin about 100°C, but on fire clays richer in silica it has less effect.

II. What is the effect of 2% or more of titanium oxide in refractories, upon their resistance to alkaline fluxes?

Discussion

The tests made by the writer were parts of a general study of the resistance of refractories to alkaline fluxes. They were made by preparing a glass of arbitrary but constant composition (using sodium carbonate and sand only) so selected that it could be melted to a thin fluid at heats obtainable in the laboratory, and consequently more alkaline than commercial glasses. Test pieces of the refractories were made into roughly cubic form. A quantity of the glass mentioned above, bearing a definite relation by weight to the test piece of refractory, was melted in a platinum crucible. The test piece was dropped into the melted glass, and allowed to remain there, covered, for one-half hour. The mass was then poured out, the glass adhering to the test piece was dissolved away, and the cleaned piece ignited and weighed. The loss in weight as compared with the original condition was taken as an index of the resistance of the refractory.

In these tests the action of the flux was confined to the surfaces of the test pieces. There was no indication that the flux penetrated the entire mass and selectively removed the less refractory components. It was recognized that this highly accelerated test might lead to faulty conclusions in deciding as to the best ratio of silica to alumina in the refractory but it was thought that by adding increased amounts of titanium oxide to a known mixture of clays that some idea of its effect might be gained. In this way the following results were obtained:

Loss from test piece made from clays containing 2–3% TiO_2	14%
Loss after adding to same mixture 10% TiO_2	27
Loss after adding to same mixture 50% TiO_2	50

Although these tests should be repeated and greatly extended to reach a right judgment as to the effect of titanium oxide, they are sufficient to create in the mind of the writer the impression that this material decreases rather than increases the resistance of refractories toward alkaline fluxes.

It may be added that similar tests with zirconia led to similar conclusions.—J. D. CARTER, Phila. Quartz Company, Philadelphia, Pa.

(NOTE—Further discussion of the above question is solicited.)

III. What is the best type of brick to use in the side walls of air furnaces?

Discussion In contributing to a discussion on the character of refractories required for service in air furnace side walls little can be added to what the writer has already said elsewhere from time to time.[1]

A very casual inspection of an air furnace at the end of a campaign discloses the fact that the greatest destruction has taken place at the slag line, until the wall has become so thin that the better preserved brick, higher up, must be removed and the lining rebuilt to prevent the wall tipping over.

Since the walls near the roof are hotter than at the slag line, it is evident that brick as now made resist temperature better than chemical action. Spalling in side walls, though not unknown, is rather unusual.

The point of attack for the side wall problem is thus to produce a chemically resistant brick. Chemical resistance, for a given material, may be increased by decreasing slag penetration by making a denser brick. Fine grinding, hard pressing, high firing temperature, and a correct grading of fine and coarse material are means in this direction.

Theoretically, it is possible to imagine a refractory less likely to combine chemically with the slag constituents. The problem would then become one of making an artificial mineral to order rather than of using natural clays.

In the malleable furnace the chemical problem is complicated by the changes in composition of a slag during melting. The first material formed is nearly pure molten Fe_3O_4. This becomes reduced promptly to FeO, and combines with SiO_2 from the brick, sand bottom, and the oxidation of Si in the metal to a final composition approximating

FeO	29.0
Fe_2O_3	1.0
MnO	5.0
SiO_2	51.0
Al_2O_3	14.0
	100.0

We have thus at various stages of the same heat slags ranging from the most basic to the most acid of open hearth practice. Fortunately, during the larger part of a heat the slag remains of the last given analysis. It

[1] Schwartz and Gorton, "The Requirements of Fire Brick Suited to Malleable Practice," *Jour. Amer. Ceram. Soc.*, **6** [10], 1094 (1923).

may be well, however, that most of the actual damage is done by the slag while basic. The entire problem would seem to possess great interest for the ceramist.—H. A. SCHWARTZ, Nat. Malleable Castings Company, Cleveland, Ohio.

Fire brick to be used in the side walls of air furnaces in the malleable iron industry must withstand high temperatures, sudden changes of temperature, and the chemical and physical action of a basic slag.

Some companies line their furnaces with coarse grained open textured brick, while others use a very fine, hard burned brick. It is probable that the best type for general use in this connection is a "happy medium" between these two extremes. Brick of open texture will naturally absorb considerable slag and this may eventually cause failure, but usually such brick, if of the proper chemical composition, glaze over and absorb very little, if any, additional slag. Hard brick will not readily absorb slag but are sensitive to thermal shock.

Siliceous clay brick fail quickly in air furnaces from spalling and from the chemical action of the slag.

The type of brick that has given exceptionally good results in the sidewalls of air furnaces has a chemical composition approximating that of kaolinite, has a fusion point of cone 32, low slag absorption, porosity of about 20%, medium grind and a light burn.—C. E. BALES, Louisville Fire Brick Works, Louisville, Ky.

IV. Does the use of powdered coal decrease the life of fire brick in malleable iron furnaces?

When powdered coal was first introduced for melting in malleable iron furnaces excellent results were obtained from the refractory lining, but later, some foundries experienced considerable trouble from slag action and flame erosion. At present, malleable iron experts are of the opinion that the brick give the same service in powdered coal fired furnaces as they do in hand-fired furnaces of the same capacity.[1]—C. E. BALES, Louisville Fire Brick Works.

In discussing the requirements of refractories for any particular service one must not lose sight of the fact that each furnace installation is a distinct problem in itself. The matter of combustion chamber design enters into the question of hand firing, powdered coal or oil burning and the service of the refractories in various parts of the furnace will be more or less satisfactory, depending on the amount of furnace experience built into the furnace.

Without doubt the use of powdered coal enables the melter to push the furnace much faster than is possible with hand firing, and the same

[1] Schurecht and Douda, "The Behaviour of Fire Brick in Malleable Iron Furnace Bungs," *Jour. Amer. Ceram. Soc.*, **6** [12], 1232 (1923).

thing applies to the use of oil. With proper combustion chamber design the service of side wall and bung brick should be as good with powdered fuel as with solid.

The same refractory will not always serve in either case and the selection of the brick to use must be made from a practical test.—Ed.

ACTIVITIES OF THE SOCIETY

PRESIDENT'S PAGE

By Robert D. Landrum

A conception of the real interest of the industries in general in what the Ceramic Society is doing is reflected in the space given to our Atlantic City Meeting by the various trade journals. The March issue of the *Ceramic Industry* uses eighteen pages and nineteen cuts, a very well-written article covering in detail the general session as well as the sessions of each of the seven industrial divisions. They say that this meeting was the "biggest and best Convention that this august body has every had." The *Chemical & Metallurgical Engineering* in their Feb. 11th and Feb. 18th issues use nine pages and nine illustrations, reporting especially in detail the general session and the sessions of the Refractories, Enamel and the Glass Divisions. The *Glass Industry* devotes four and one-half pages and uses twelve illustrations in reporting our meeting, and are especially to be commended for their excellent account of Glass Division Meetings. The March number of the *Brick & Clay Record* covers very completely the Convention activities of the Heavy Clay Products, the Refractories, the White Ware and the Terra Cotta Divisions, using six pages and three cuts; and the *Enamelist* in two pages reports the Enamel Division Meeting. The *Clay Worker*, the *Glass Budget*, the *Glass Worker*, the *China, Glass and Lamps* and the *Pottery Glass and Brass Salesman* were liberal in the space given to the report of this Convention.

A comment of *Chemical & Metallurgical Engineering* in reporting our Convention is especially to the point, for it emphasizes an admirable quality typical of our Society, a quality that is fundamental in our success. The comment is as follows:

"From the climatic point of view, Monday, February 4th was perfect and the fact that nearly three hundred resisted the natural temptation to join the throng on the board walk speaks well for the excellence of the program and is an indication of the genuine interest in the activities of the industry that permeates this organization."

As a matter of fact, practically every member at any one of our meetings finds that if he misses a single hour, he has missed something of real definite value in his work. Even more attractive than the opportunity to bask in the sunshine of a Spring day in February and to fill our lungs with the unbreathed air, fresh from over the Atlantic Ocean was the opportunity to revel in the discussion of our every-day problems and to drink to our full the inspiration from papers by resourceful fellow workers who had put in black and white some of the things we have long wanted to know.

Inspiring research work along the right lines is an important work. This is being handled as effectively by the service committees as can be expected under the conditions. The immediate and most urgent task of the Board is to show those who are being benefited just how they can make the work of these committees more effective. Our field of usefulness and the expectations of the service have increased faster than our income will allow. There are many things we should do which we cannot without a larger income. The Society is solvent and is now operating within its income but our activities are far from what they should be.

Our funds come from three sources—dues from the members, both personal and corporation; payments we receive from our advertisements in the *Journal;* and the receipts from the sale of our publications. The Board of Trustees considered a long time before increasing the dues of the members from $7.50 to the constitutional limit of $10.00.

It would be better to have every corporation an interested member at $25.00 a year rather than a fewer number at a larger fee. The larger number of members has a double result; gives us more capital to work with and adds another worker. Both of these increase our ability to serve. Any efforts we make to increase our list of cor-

poration members will assist in making the industries as a whole realize that our activities have a real value from the dollar standpoint.

In just the same way, when we obtain a new advertiser, we are doing him a distinct service, for our *Journal* goes to a selected list of men to whom he can for a very small sum of money tell his story each month and reach them when they are in a receptive mood. Our members and the readers of the *Journal* are the men who make the final decision regarding materials and equipment to be used.

You, who are reading this page, are the fellows who can make our financial problems easy. You know a man in an organization already a corporation member who should be a personal member. You know a corporation—perhaps it is your own—that is benefiting from the work of our SOCIETY and yet is not a corporation member. Every day you are buying materials from companies not represented on our advertising pages. Just think what it would mean to the SOCIETY if everyone who reads this page would write today to one man who should be a personal member, to one corporation that should be a member, and to one supplier of materials who should be an advertiser. Here are the fruits of work done in the securing of new members last month.

MEMBERSHIP WORKER'S RECORD

	Personal		Personal
Alfred O. Ashman	1	J. W. Mellor	1
A. U. Cote	2	R. C. Rahn	1
F. W. Donahoe	2	Frank S. Roberts	2
R. F. Ferguson	2	W. F. Rochow	1
Howells Fretchett	1	John Sawyer	2
C. B. Harrop	1	Alexander Silverman	1
Charles J. Hudson	1	Office	9
Eugene J. Hysell	1		—
R. D. Landrum	1	Total	29

The Roster Continues to Rise

	Personal	Corporation	Totals
Net Record Jan. 15	1990	296	2286
Acquisition up to Feb. 15	41	8	49
Acquisition up to Mar. 14	29	0	29
Gross Totals March 14	2060	304	2364
Withdrawals	68	5	73
Net Roster Mar. 14	1992	299	2291

NEW MEMBERS RECEIVED FROM FEBRUARY 15 TO MARCH 15

PERSONAL

Andrews, Andrew Irving, Graduate Student, U. S. Bureau of Mines, Lord Hall, Ohio State University, Columbus, Ohio.

Aregood, Joseph M., Foreman Molding Dep't, Vitrefrax Company, 1317 E. 61st St., Los Angeles, California.

Buit, Theodore, Enameling Dep't, Alaska Refrigerator Co., 36 Rathburn St., Muskegon, Mich.

Carter, C. C., Sup't Buckeye Tile Co., Chillicothe, Ohio.
Cochran, A. D., Salesman Clay Working Machinery, Bonnot Co., Careton, Ohio.
Devereux, Percy Stewart, Works Mgr., The British Abrasive Wheel Co., Ltd., Tinsley, Sheffield, England.
Duggan, Adele Ida, Occupational Therapist, U. S. Veteran's Hospital No. 16, Oteen, N. Carolina.
Helmer, Charles M., General Mgr. Hall and Sons, Inc., 69 Tonawand St., Buffalo, New York.
Holland, Henry Donald, Engineer Crooksville Shale Brick Co., Crooksville, Ontario.
Howe, W. L., Research Assistant, Norton Co., 16 Greendale Ave., Worcester, Mass.
Kane, Richard S., Draftsman, C. B. Harrop, 1591 N. Fourth St., Columbus, Ohio.
Lewis, Nathan E., Engineer of Babcock & Wilcox Co., 85 Liberty St., New York City.
Mauser, H. W., Jr., Engineer, Royal Delftware Manufactory, 20 Julianalaan, Delft, Holland.
McLaughlin, N. H., Sec'y Alsey Brick and Tile Co., Alsey, Illinois.
Myers, E. F., President, The Ironton Fire Brick Co., Ironton, Ohio.
Miller, William B., Ceramic Section of the Research Dept., N. J. Zinc Co., 462 Lafayette Ave., Palmerton, Pa.
New, Ryland H., President, The Hamilton & Toronto Sewer Pipe Co., Ltd., Hamilton, Ontario, Canada.
Poxon, G. J., Pottery Manufacturer, 2300 E. 52nd St., Los Angeles, Calif.
Remsen, John N., Assistant Gen. Sales Mgr., United Alloy Steel Corp., Canton, Ohio.
Robertson, Foster, Junior Fellow, Mellon Institute, Pittsburgh, Pa.
Rodgers, Henry P., Partner, Rodgers and Reitz, 15 E. Fayette St., Baltimore, Md.
Roefer, Chas. M., Ceramist, Federal Clay Products, Mineral City, Ohio.
Roy, William, Sup't, Crooksville Shale Brick Co., Crooksville, Ont., Canada.
Schwall, Harry Edwin, Aid to Sup't, Southern Potteries, Inc., 605 Ohio Ave. Erwin, Tenn.
Sheppard, F. W., Harbison-Walker Refractories Co., Brown Marx Bldg., Birmingham, Alabama.
Spence, Hugh S., Mining Engineer, Mines Branch, Dep't. of Mines, Ottawa, Ontario, Canada.
Thorman, Floyd M., Laboratory Supervisor, United States Gypsum Co., Oakfield, New York.
West, Charles, President, Glass Manufacturing, Grapeville, Pa.
Willmer, Heinrich, Heat Efficiency Expert, Cologne Nippes, Germany.

NEW ENGLAND SECTION MEETING

The first meeting of the year for the New England Section of the American Ceramic Society was held at the Boston City Club on March 8th with the following members and friends present.

J. R. Fuller, Hygrade Lamp Company, Salem, Mass.
R. Booth, General Electric Co., Lynn, Mass.
R. P. Newhall, General Electric Co., Lynn, Mass.
H. L. Young, Bristol Company, Old So. Bldg., Boston, Mass.
J. F. Indordohnen, Bristol Company, Old So. Bldg., Boston, Mass.
W. L. Howe, Norton Company, Worcester, Mass.
G. L. Nordin, Superior Corundum Wheel Co., Waltham, Mass.

Wm. Pettigrew, Norton Company, Worcester Mass.
Glenn D. Williams, Norton Company, Worcester, Mass.
Arthur T. Malm, Norton Company, Worcester, Mass.
Charles J. Hudson, Norton Company, Worcester, Mass.
Gustaf A. Hiding, Norton Company, Worcester, Mass.
H. L. Watson, General Electric Co, Lynn, Mass.
O. C. DuSossoit, Taylor Instrument Co., Boston, Mass.
C. B. Tilton, Cortland Grinding Wheel Co., Chester, Mass.
Leon B. Bassett, Baxter D. Whitney & Son, Winchendon, Mass.
Elliot D. May, Baxter D. Whitney & Son, Winchendon, Mass.
Prof. Gordon B. Wilkes, Mass. Inst. of Tech., Cambridge, Mass.
Prof. Charles L. Norton, Mass. Inst. of Tech., Cambridge, Mass.
Dr. S. W. Stratton, Mass. Inst. of Tech., Cambridge, Mass.
R. Richardson, Mass. Inst. of Tech., Cambridge, Mass.
Irving B. Loud, Norton Company, Worcester, Mass.
Edwin G. Chaffin, Norton Company, Worcester, Mass.
George Henderson, Dorchester Pottery Wks., Boston, Mass.
R. M. Farnsworth, Lancaster, Mass.
M. F. Cunningham, Waltham Grinding Wheel Co., Waltham, Mass.
C. H. Lawson, Waltham Grinding Wheel Co., Waltham, Mass.
Albert A. Klein, Norton Company, Worcester, Mass.
Arthur E. Baggs, Marblehead Potteries, Marblehead, Mass.

At the election of officers it was voted that the same members serve again for 1924.

The speakers for the evening were, Dr. S. W. Stratton and Prof. Charles L. Norton, and Prof. Gordon B. Wilkes of the Massachusetts Institute of Technology.

They spoke on "The Proposed Development of Ceramics" and "Ceramic Research at the Technology."

A general discussion followed.

Tentative plans were suggested on forming a committee representative of the Ceramic Industries of New England to meet with Prof. Norton and his associates to formulate means whereby the Technology could better coöperate with the New England Ceramic Industries and help them with their problems.

The suggestions met with a great deal of enthusiasm and further work will be done along this line.

At the close of the discussion a rising vote of thanks was extended to Dr. Stratton, Prof. Norton and Prof. Wilkes and the meeting adjourned.

C. H. Lawson, *Secretary-Treasurer*

FIRST CERAMIC MEETING[1]

Southern California Section of American Ceramic Society Discusses Future of Industry

A representative gathering of the heads of many important clayworking, refractories and other ceramic industries of Los Angeles and vicinity met at the Hotel Clark during the week, the occasion being the first regular meeting of the newly organized Southern California section of the American Ceramic Society, a national organization devoted to the advancement of the ceramic industry.

[1] *Los Angeles Sunday Times*, Mar. 2, 1924.

The officers of the local section are: A. Malinovsky, president; G. Ray Boggs, vice-president; Thomas S. Curtis, secretary-treasurer. Its membership is made up of the technical and executive heads of departments of practically every important ceramic manufacturing concern in the Southwest.

Interspersed between the various discussions of economic and technical interest, were musical numbers rendered by the young daughter of the president, Miss Olga Malinovsky, pianist, with violin by Master Charles Malinovsky. B. C. Berg, of the Schurs Oil Burner Company, sang.

Among the most welcome speakers of the evening was Prof. Hewitt Wilson, head of the department of engineering of the University of Washington. After showing the gathering that Seattle can boast and boast quite as enthusiastically as Los Angeles, Prof. Wilson gave an intensely interesting account of the work at the University, which work has had the collaboration of the United States Bureau of Mines through the Northwest Experiment Station. The first, and probably the most important work accomplished to date, has been a thorough survey of available raw materials, of which there appears to be an inexhaustible supply and a very considerable variety. It is Wilson's opinion, founded on this investigation, that the Northwest will some day be as independent from the ceramic standpoint as is Los Angeles, although much development work and a huge investment must needs be made before that section can hope to approach the importance of the Southwest in this big industry.

An intimation of the value of the American Ceramic Society in its relation to the economic development of the high temperature industries of the Southwest, was manifest in an informal talk by Thomas S. Curtis, president of the Vitrefrax Company of Los Angeles. This Company, a little more than three years ago, started the manufacture of super-refractories in a small plant in the Vernon district, specializing in the most difficult problems of the industry. From that small beginning, the Vitrefrax Company has grown to hold an unparalleled place in the refractories field, with an investment of nearly three-quarters of a million dollars in a modern steel and concrete plant, conceded by eastern visitors to be the finest and most unique refractories institution in the world. The business is nation-wide, approximately 70% of the product being shipped to eastern steel mills, copper refineries and electric furnace plants.

An appeal by Curtis, to the members of the fire-brick industry present brought to light a curious misapplication of technical data, as applied to the sales of fire brick. It appears that for many years it has been the custom to describe a fire-brick as being able to "stand so many degrees of temperature." The salesman having a high grade brick, refers to his brick as being able to stand 3200°F, for instance. This is commonly accepted as the melting point of the brick, and leads one to believe that the brick is satisfactory for service up to that point.

Mr. Curtis brought out the point that this is misleading unscientific and occasionally dangerous, for the reason that a softening takes place in all firebrick in some cases a thousand degrees below the actual melting point. It is the softening or deformation point that determines the suitability of the brick for service in specific cases. His plea was for all fire-brick makers to get together and agree to a specification or description of the characteristics of a fire brick that would give the customer and especially the engineer an inkling of the adaptability of the brick in his own problems.

To accomplish this, a new set of standards would have to be used. The melting point could be ignored altogether, and the temperature at which warping occurs, under a known load and shear stress, would be used as the indicator. The practical value of this suggestion has been recognized by customers of the Vitrefrax company all over the country, the appeal being unique in that it serves to give the customer an idea of the practical or utilitarian value of the brick in service.

The discussion which resulted from this suggestion was right to the point, and it showed the intense interest of a great majority of members who were not firebrick manufacturers but fire-brick users.

Other speakers on the program were Samuel Geijsbeek, who helped to organize the first section of the AMERICAN CERAMIC SOCIETY many years ago in the East; Mr. Steinhoff, of the *Brick and Clay Record*, and *Ceramic Industry*, two leading journals of the industry; Mr. Weber, of the Russell tunnel kiln organization of St. Louis; and Mr. Jackson, of the Empire China Company of Burbank. Mr. Jackson spoke on the availability and suitability of white burning clays and other ingredients of the raw mix in white chinaware.

Plans for the summer meeting of the SOCIETY to be held in Los Angeles were discussed by the presiding chairman, F. B. Ortman, of Tropico Potteries, Inc. A program has been arranged for the visiting members from the East, and it is estimated that more than one hundred visitors with their wives will come to Los Angeles on this occasion. Many plant visits have been planned, and it is believed that this influx of the heads of important ceramic plants of the eastern section may serve to stimulate further the development of our already full-fledged ceramic industry here in the Southwest.

ST. LOUIS LOCAL SECTION MEETING[1]

On March 18, 1924 the St. Louis Local Section of the AMERICAN CERAMIC SOCIETY held their quarterly meeting at the American Annex Hotel. "Oxygen—the Wonder Worker" was the title of an interesting motion picture illustrating how liquid air is made and why oxygen can be extracted from the air; how acetylene is made, and how gases are used by modern industry to effect the economies of oxyacetylene welding and cutting. This picture was produced by the United States Bureau of Mines in co-operation with the Air Reduction Sales Company. G. E. Harcke, industrial engineer for the latter Company, gave a talk on the same subject.

A special feature of the meeting was an actual demonstration of machine flame-cutting devices.

Reports by various members who attended the Atlantic City Meeting were given and a discussion of the proposed Ceramic Department at the University of Missouri was given.

PITTSBURGH LOCAL SECTION[2]

Members of the Pittsburgh Local Section of the SOCIETY held a meeting on the evening of March 20 in the Auditorium of the Pittsburgh Section of the U. S. Bureau of Mines. The address of the evening was given by Dr. Albert Sauver, Professor of Metallurgy of Harvard University. His subject was "The Behavior of Steel under the Action of Heat."

DENVER NOW IN SUMMER MEETING SCHEDULE

Attractive Addition Made to Itinerary

Daily increasing interest in the plans for the Summer Meeting tour to the western coast of the United States is being manifested by the members of the AMERICAN CERAMIC SOCIETY. The latest announcement that Denver will be visited on the return trip

[1] L. C. Hewitt, Secretary.

[2] H. G. Schurecht, Secretary.

with the Denver ceramists as cordial hosts has been greeted with enthusiasm. This latest addition to the itinerary has been made with *no* additional railroad fare.

The ceramic party will leave Los Angeles for Grand Canyon and after a visit there will go directly to Denver for plant and social visits.

The itinerary for the four weeks' trip is as follows:

Leave Chicago	July 21
Spokane	July 25
Seattle	July 26–28
Lincoln	July 30
San Francisco	July 31–August 2
Yosemite Valley	August 4, 5 and 6
Los Angeles	August 7, 8 and 9
Grand Canyon	August 10
Denver	August 13

Chairman Ortman of the Western Committee sends enthusiastic accounts of the plans being perfected for the comfort and enjoyment of the visiting ceramists and their families.

Members are requested to send in their names for reservations to the Office of the Secretary, Lord Hall, O. S. U., Columbus, Ohio, on or before June 1, 1924.

OFFICERS OF THE GLASS DIVISION

G. E. Barton, Chairman of Glass Division

G. E. Barton, elected chairman of the Glass Division at the Atlantic City Meeting, was born at Worthington, Mass., May 9, 1871, of old New England stock. He received the degree of B.S. from the Worcester Polytechnic Institute in 1891, and M.S. from George Washington University in 1895. He was assistant Chemist at the Naval Torpedo Station, Newport, R. I., 1891–92, Chemist to The Aetna Powder Co., Aetna, Indiana, 1892–94; and private assistant to Dr. Charles E. Munroe, the explosives expert, 1894–96.

G. E. Barton

From 1896 to the present he has been the chief scientific advisor of Whitall Tatum Company. This concern made and marketed the first American borosilicate glass, for other than optical purposes, as "Nonsol" Chemical Ware in 1902.

He is a member of the American Ceramic Society, The American Chemical Society, The Society of Chemical Industry (London), The Societe de Chemie Industrielle (Paris), The American Institute of Chemical Engineers, The Society of Glass Technology (England), and a fellow in The American Association for the Advancement of Science.

In the American Chemical Society, he served on the Committee on "Graduated Chemical Glassware" which convinced that organization of the necessity of a Bureau of Standards and which was active in obtaining the passage by Congress of the Bill creating the

same. Correspondence which he had with President Hillebrand of the same Society in 1906 led to the appointment of a committee of which he was a member on the relation of industrial chemists to the Society. The work of this group led to the publication of *Chemical Abstracts* in 1907, and of The *Journal of Industrial and Engineering Chemistry* in 1909. He also has served the same organization as Associate Editor of The *Journal of Industrial and Engineering Chemistry*, Assistant Editor of *Chemical Abstracts* during its entire existence, Councillor from 1908 to the present, and Chairman of the Philadelphia Section in 1921.

ALFRED N. FINN

Alfred N. Finn, Newly Elected

Born and educated in Denver, Colo. Graduate of the University of Denver, A.B. (1906), A.M. (1909), having specialized in chemistry, mathematics and physics. Instructor in Chemistry, University of Denver, until appointment at Bureau of Standards in 1911. After eight years in chemical testing of structural materials, he resigned to enter the Research Department of the Hydraulic Steel Co., Cleveland, Ohio. Reinstated at Bureau of Standards in 1920 in his present position in the Glass Section. He is a member of the American Chemical Society, 1912, American Society for Testing Materials in 1913, AMERICAN CERAMIC SOCIETY, 1922, and the Optical Society of America, 1923.

NOTES AND NEWS

SOCIETY OF GLASS TECHNOLOGY MEETINGS

The February meeting of the Society of Glass Technology was held in Sheffield on February 20. In the morning there was an exhibition and demonstration of modern pyrometers at the Department of Glass Technology of the University. The following firms exhibited:

1. The Bowen Instrument Co., Ltd.
2. The Cambridge & Paul Instrument Co., Ltd.
3. The Foster Instrument Co.
4. The Optical Pyrometer Syndicate.
5. Messrs. Booth & Miller also demonstrated their New Temperature Controller.

At the afternoon session the subject under discussion was "The Use of Pyrometers in Glass Works." Five papers were presented.

I. "The Use of Pyrometers in Glass Works," by E. A. Coad-Pryor

The value of pyrometric equipment in a glass factory depends essentially on three factors:—

1. The reliability of the pyrometer itself, particularly the clock-work;
2. The skill which is expended on its maintenance; and
3. The attitude with which the management, foremen and furnace operators regard the pyrometer.

Of these three the last was regarded as the most important. The pyrometer in no way displaced the trained eye; its real function was to supply further information

in order that a highly skilled operator might be able to get more out of his plant than had hitherto been possible.

The range of temperatures to be measured could conveniently be subdivided into 3 groups.

1. The range 0° to 700°C, covering leers, stack temperature, producer gas, etc.
2. From 700° to 1200°C, regenerator temperature, pot work, and
3. Above 1200°C, the temperature of the melting furnaces.

In the first group the thermocouple was the most convenient instrument to use. Some sort of a portable thermocouple should be part of every works equipment. A convenient couple for low temperature work was iron-constantan: the wire to be about 22 gauge.

In the high temperature ranges an optical or total radiation pyrometer was, as a rule, the most convenient. The tank furnace might be subdivided into 3 zones: the melting zone, the plaining zone, and the refining end. Two permanent pyrometers should be used on each furnace, one on the refining and the other sighting through a hole in the end wall at the melting end of the furnace. The use of couples embedded in the wall of the tank or in the crown caused probably more trouble than they were worth.

The optical or radiation pyrometer if used with discretion, was the most reliable and the most easily applied. The author's experience was that the optical instruments gave less variable readings than did the radiation instruments. The all important factor with any installation was the training of the staff and operators to use the instruments with intelligence as an aid to the maximum efficiency in furnace manipulation. A bibliography was added to the paper.

II. Continuous High Temperature Measurements in Glass Works, by W. M. Clark

In the strictest sense of the term there was probably no absolutely accurate method existing for constantly determining glass house temperatures. We could only approach this desirable aim by refinements of installation and careful maintenance, and this meant both equipment and maintenance expense. Therefore, in considering the subject of a pyrometer installation the glass manufacturer must balance the factors of what his demands for accuracy will be worth against the initial and operating costs of various systems. It is always advisable to install both the indicating and recording type of instrument, side by side.

Experience at a number of modern well laid out plants showed that pyrometric measurements were reflected in the costs sheets. The morale of the furnace men was improved by eliminating the human errors of judgment in guessing at temperatures and cost per unit of output decreased. With improvements in pyrometric equipment the tendency was for their more extensive use around glass works. The depreciation on such equipment was not excessive, about ten per cent per annum being a fair amount, judging from successful installations and as improvements came along they could be incorporated into the system, replacing features which became obsolete and thus keeping the installation up to date. A well-planned system would reduce overall costs in a year more than sufficient to pay for the investment and often would leave several times this amount if used intelligently.

The most forceful argument for the adoption of pyrometer control in a glass works was on the score of economic savings but the information, thereby made available to the management and staff, was also important in showing each man a tangible effect of his operation on the thermal conditions. The producer man saw that good gas was necessary to maintain temperature, the furnace man saw the result of proper draft

regulation, the foreman of the finishing department could be satisfied whether the ware was being properly annealed and the whole schedule of production was benefited.

III. Recent Advances in the Design of Temperature Measuring Instruments, Etc., by R. W. Whipple

One difficulty in connection with disappearing filament pyrometers was to get two lamps which would be interchangeable. Methods for overcoming this difficulty were indicated. The speaker then said how greatly he had been impressed with what he had seen recently in the United States in the matter of automatic temperature control. He understood considerable work was being done in this connection in glass works and referred to the works of Messrs. Keuffel & Esser when leer temperatures were controlled from 200°C to 600°C. For every kind of glassware a special cooling curve was followed. In the United Kingdom automatic temperature control was being developed. The main principle in such control was a galvanometer needle which was deflected by some method. Lantern slides were then exhibited showing various forms of controller, including (1) Brown, (2) Bristol, (3) C. Engelhard, (4) Leeds & Northrup, (5) Cambridge, (6) Barr, (7) Althorpe. It should be possible to control leer temperatures by some such automatic control apparatus, and so to lessen the worries of the works manager.

IV. Practical Applications of Pyrometers to Glass Works, by C. E. Foster

Both optical and total radiation instruments were calibrated for what was known as "black body" condition and when used on hot bodies which were not technically known as "black bodies," the reading would be in error by an amount which varied with the actual condition. An ordinary large glass melting tank was by no means a "black body." The author suggested that luminous gas flames might have the power of selective emission, that is, they radiated a light which was not in proportion to their temperature, but might be of an intensity which would correspond to the brightness of a solid hot body at a much higher temperature. Considering a surface of molten glass viewed obliquely in a furnace that did not realize "black body" conditions, it obviously had a considerable reflecting power, but he found that its reflecting power as experienced in measuring with a total radiation pyrometer was relatively much less than the unoxidized surface of molten metal. Further consideration showed that this was reasonable because there was some considerable transparency in the glass so that it would actually emit a greater proportion of the heat from inside. Thus it was actually found that molten glass approached more nearly to a true "black body" than unoxidized molten metal.

V. Reflections on Pyrometer Design, by W. Bowen

Economy in fuel consumption, long life of furnaces or other heating devices employed, elimination of waste of raw materials and of irreparable losses of finished products all depend upon the raising of the heat-treated materials to no less, and no more, than the requisite temperatures. The value of pyrometers to such heat-treatment problems was now too well recognized to need discussion. A few of the standards which a good pyrometer should fulfill were as follows: (*a*) Simplicity of design and operation, (*b*) Robustness and freedom from liability to breakdown under shock or accident, (*c*) Flexibility of apparatus to meet the practical conditions, (*d*) Long and stable life of pyrometer, (*e*) Speedy response to temperature changes, (*f*) Automatic action, (*g*) Accuracy. These standards were then discussed with reference to the new "Pyro" radiation pyrometer, an instrument compact in shape, extremely portable and simple in operation.

The January Meeting.—A meeting of the Society of Glass Technology was held in the College of Technology, Manchester, on Wednesday, January 16, 1924, the Pres-

ident, W. E. S. Turner, being in the chair. A paper by the president on "Specifications for Glass" formed the basis of an interesting discussion. J. H. Steele directed attention to a circular which he had received in which the use of glass for food containers was attacked. It was further stated that glass splinters were a possible cause of appendicitis and cancer. E. A. Coad-Pryor suggested the desirability of having some open preliminary specifications based upon durability alone. What was needed was some simple test which could be easily applied in the works. Fuller specifications could be made as experience accrued. Professor Turner in the course of his reply said that his attention had already been directed to the circular to which Mr. Steele referred. As the matter was one of some importance to the glass industry he had felt constrained to consult some of the leading pathological and surgical experts in this country and to obtain their views on the subject. The answers which he had received very definitely refuted the charge that glass splinters was a cause of either appendicitis or cancer.

The next paper considered was entitled "The Production of Colorless Glass in Tank Furnaces, with Special Reference to the Use of Selenium" by A. Cousen, and W. E. S. Turner. Mr. Cousen summarized previous work done by the authors on this subject and gave the results of their latest experiments. Some types of commercial glass, including modern colorless glass jars, began to turn yellow when exposed for some time to light. This happened when stacks of jars were kept for a time in the open yards of glass factories. It was now shown that glasses which had been decolorized by selenium, together with arsenic showed this yellowing effect on exposure to sunlight. On the other hand, glasses which were originally yellow, due to the presence of selenium without arsenic, became bleached by sunlight. It had previously been observed that the yellow selenium glasses when reheated to temperatures of 500° to 600°C became distinctly deeper in color, the maximum deepening being reached at a temperature of about 550°. When, however, a number of pink glasses such as are obtained by melting batches containing selenium along with arsenious oxide or sodium nitrate are reheated at the same temperatures, distinct loss of color occurs. This loss is slow at 525° but is very appreciable even after an hour at 575°, the upper annealing temperature of the glass itself. Such a color change would be obtained in a leer when the pink glasses were being annealed, and would call for careful regulation of the temperature during the process.

A paper emanating from the Department of Glass Technology of the University of Sheffield and entitled "Further Contribution to the Study of the Effect of Alumina in Glass," was taken as read.

COLONEL PRATT IN NEW WORK

At the meeting of the State Geological Board, held in Raleigh, February 1, Colonel Joseph Hyde Pratt, who is *ex officio* Director of the State Geological and Economic Survey, tendered his resignation as State Geologist, a position he has held since 1906.

Colonel Pratt is now actively engaged in his new work as President of Western North Carolina, Inc., an inter-county association whose purpose, as its name indicates, is the advertisement and general development of the resources and material and social possibilities of the rapidly prospering mountain section of the State.

The new director is Brent S. Drane, civil engineer of Charlotte, N. Car.

The first meeting of the Czechoslovak Ceramic Society in Praha.

CZECHOSLOVAK CERAMIC SOCIETY

By Rudolf Barta[1]

New Ceramic Society, Organized in December, 1923

Czechoslovakia has long stood in need of a scientific center in ceramics. This country abounds in first class raw materials and her ceramic industry is on a high level. Therefore, on December 11 the ceramic engineers founded in Praha, the Czechoslovak Ceramic Society. It is the fifth corporation of this kind in the whole world, and the second on the Continent of Europe. The Society is organized after the American model. The membership for foreigners is Kč 50, for a Society Kč 500.

Dr. Frank Fischer,
The first president of the Czechoslovak Ceramic Society.

The *Journal* of the Society will appear occasionally. As three of the ceramic societies use the English language, our *Journal* will contain English abstracts.

Up to this time the work of our ceramists has not been known abroad, as most of our works have been written in the Czech language, which is not much known abroad.

Foreign countries have heard of us through foreign newspapers, and therefore we were supposed to belong to other nations. The interest for this new society is very great throughout Central Europe.

The first elected president is Frank Fischer, one of the most distinguished workers.

The Czechoslovak ceramists would be pleased to enter into scientific connections with the Americans.

[1] Secretary of the Czechoslovak Ceramic Society.

RESEARCH FELLOWSHIPS

At the College of Mines, University of Washington and the Northwest Experiment Station, U. S. Bureau of Mines, 1924–1925

The College of Mines of the University of Washington offers five fellowships for research in Mining, Metallurgy, and Ceramics in coöperative work with the Bureau of Mines. The fellowships are open to graduates of universities and technical schools who are properly qualified to undertake research investigations. The value of each fellowship is $810 per year of twelve months, beginning July 1st. Fellowship holders pay the usual tuition and partial laboratory fees; they register as graduate students and become candidates for the degree of Master of Science in Mining Engineering, or in Metallurgy, or in Ceramics, unless an equivalent degree has previously been earned.

The purpose of these fellowships is to undertake the solution of various problems being studied by the United States Bureau of Mines that are of especial importance to the State of Washington, the Pacific Northwest, and Alaska. The investigations consist principally of laboratory work directed largely by the Bureau's technologists. For the year 1924–1925 the following subjects have been selected for investigation:

(1) Beneficiation of coal, especially coal washing.

(2) Electrometallurgy. Iron and steel problems. Super-refractories.

(3) Ceramics. Super-refractories, whiteware bodies, and other problems.

For information write to Dean Milnor Roberts, College of Mines, University of Washington, Seattle, Washington.

BUREAU OF STANDARDS

Exhibit of Ceramic Ware

The Bureau of Standards at Washington, D. C., is sending to the various manufacturers of vitrified and semi-vitrified ware, enamelers, manufacturers of glass, art pottery concerns, and in fact to the manufacturers of every variety of ceramic ware, a form letter requesting that they submit a few samples of their product which is either intricate in shape or has some artistic value.

These samples are to be placed on permanent exhibit. Such an exhibit will be of benefit to every one concerned since it will bring before the many visitors to the Bureau the products of the American ceramic industry. The Bureau has gone to considerable trouble to prepare an adequate case for these exhibits and is making every endeavor to present them in such a way that they will appeal to the popular eye.

"Cut-Offs" for Glass Bottle Machines

For some time the Bureau has been investigating the material used for "cut-offs" which are employed to control the flow of glass in automatic bottle machines. Ten shapes were made up during the past month, using two bodies which have been found to be resistant to glass attack and spalling. It has been thought that casting instead of pressing would eliminate some of the trouble now experienced in the industry through the failure of these "cut-offs."

Judging from the raw batch of bodies sent in by manufacturers, a change in body will be necessary if casting is to replace pressing, as the present one is too deficient in plastic clay and probably contains too much impurity to cast successfully.

Compressive Strength of Sand-Lime Brick Walls

Ten sand-lime brick walls and 12 wallettes were tested in the 10,000,000 lb. vertical machine during the month. Half of these were built with cement-lime mortar and half with lime mortar. The tests showed the former to be more than twice as strong and roughly about ten times as stiff as those built with lime mortar.

The latter walls, however, showed a compressive strength of about 300 lb. per sq. in., which means that under its own weight such a wall would have to be 350 feet high before it would crush at the bottom.

Judging from the opinions of various engineers and others who have witnessed these tests, the results, covering as they do unusually large wall specimens, will furnish very valuable data for use in future construction.

BUREAU OF MINES NOTES

Refractory Kiln Survey

A number of operators of refractory kilns have asked the Department of the Interior to detail engineers of the Bureau of Mines to look over their burning conditions with the idea in view of determining whether it is likely that a saving in fuel could be effected by a service similar to that rendered to the refractories manufacturers by the Bureau last year. This work will be in coöperation with the Refractories Manufacturers Association.

Burning Problems of Industrial Kilns

Important fuel economies in the operation of industrial kilns manufacturing brick, tile and other heavy clay products have been made possible as the result of a study of the burning problems of such kilns, made by the Department of the Interior in coöperation with the Four Heavy Clay Products Associations. In the course of the investigation, engineers of the Bureau of Mines, traveling on a specially-equipped laboratory car, conducted studies of actual firing conditions at typical plants producing common brick, face brick, paving brick, and hollow building tile. The practical demonstrations of the Bureau of Mines engineers resulted generally in a considerable reduction of time of burning, a material lessening in the amount of fuel consumed, and improvement in the quality of the manufactured product. The results of this investigation have been incorporated in a report on "The Burning Problems of Industrial Kilns," published by the Four Heavy Clay Products Associations, composed jointly of The National Paving Brick Manufacturers Association, The Common Brick Manufacturers Association, The American Face Brick Association, and the Hollow Building Tile Association.

Utilization of Anhydrite

The anhydrous form of gypsum, which occurs in large quantities in some mines, is difficult to utilize. In the hope of obtaining information which may lead to a more efficient utilization of such types of gypsum, a study of the chemical and physical properties of the whole series of calcium sulphates has been undertaken by the Department of the Interior at the Non-Metallic Minerals Station of the Bureau of Mines, New Brunswick, N. J. The bureau will attempt to determine (1) the stability of gypsum and anhydrite in their relation to gypsum ore reserves and (2) the properties of anhydrite in their relation to better utilization. A preliminary study has been made of physical-chemical work that has already been accomplished, bearing on this subject. Samples of anhydrite and gypsum have been obtained from gypsum mines.

Refractories for the Melting of Platinum

Last month a sample of fused zirconium oxide was obtained from a company which is developing the production of fused zirconia on a commercial scale. Small crucibles of this fused zirconia have been made in the laboratory without an added oxide bonding material and with additions of 20% thoria or 15% aluminum. Very promising results have been obtained since several of the crucibles have satisfactorily withstood very sudden and uneven heating in the oxyacetylene flame and even quenching in water from temperatures as high as 1700° or 1800°C. Actual melting tests with platinum will be carried out in the induction furnace as soon as possible.

REQUEST FOR UNPUBLISHED DATA

The Editorial Board of International Critical Tables will appreciate receiving from scientific investigators any numerical data which they are able and willing to furnish, which have not been published prior to January 1, 1924. All data are desired which characterize the behavior of any definite material, substance or system. For the purpose of this request, such data will be divided into two classes, as follows: Class I, data which constitute the only information of the kind available; Class II, data which, in the opinion of the investigator, substantiate, extend or improve upon existing information of the same kind.

In connection with data belonging to both classes, the following information should be given: (*a*) an exact definition of the material, substance, or system to which the data apply; (*b*) the investigator's estimate of the accuracy of the values; (*c*) the name of the investigator or investigators responsible for the measurements; (*d*) the laboratory in which the investigations were carried out; (*e*) a brief statement of the experimental method used; (*f*) an exact statement of the units in which the data are expressed; and (*g*) any other supplementary information necessary for the complete characterization of the data.

For data belonging to class II, such additional data should be furnished as will enable the expert in charge of this class of data to critically evaluate the new in comparison with the older data. Manuscript or corrected page proofs should be furnished where possible.

Any data belonging to class I received prior to January 1, 1925, and any data belonging to class II received before July 1, 1924, will be in time for inclusion in "International Critical Tables," and the source of all data so included will be indicated by "Private Communication from," etc., or in such other manner as the author may prefer, unless a literature reference becomes available before going to press. Data determined by members of the staff of a research laboratory should be forwarded through the Director of the laboratory. All data should be sent to "International Critical Tables," National Research Council, Washington, D. C.

ELECTRIC FURNACE REFRACTORIES

The American Electrochemical Society will have a round table discussion of electric furnace refractories in New York City, April 24. They desire that as many as are interested shall attend. Dr. M. L. Hartman of Carborundum Co., Niagara Falls is in charge.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21– Aug. 1924	Trip to Pacific Coast
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
American Electrochemical Society	April 24	New York City
Am. Foundrymen's Assn.	Oct., 1924	
Am. Gas Assn., Inc.	Oct., 1924	

Organization	Date	Place
Am. Iron and Steel Institute	May 23, 1924	New York
Am. Zinc Institute, Inc.	Apr. 28–29, 1924	St. Louis, Mo.
Assn. of Scientific Apparatus Makers of U. S. A.	Apr. 25–26, 1924	Washington, D. C. Bureau of Standards
British Assn. for the Advancement of Science	Aug. 6–13, 1924	Toronto, Canada
Chamber of Commerce of the U. S. A.	May 6–8, 1924	Cleveland, Ohio
Chemical Equipment Assn.	Sept., 1924	
Eastern Clay Products Assn.	Apr., 1924	
Eastern Paving Brick Mfrs. Assn.	Dec. 9, 1924	New York (?)
Glass Container Assn. of Amer.	Apr. 25, 1924	Atlantic City
Glazed and Fancy Paper Mfrs. Assn.	Wk. of Apr. 7, 1924	New York
Manufacturing Chemists' Assn.	June, 1924	New York
Natl. Assn. of Mfrs. of U. S. A.	May 19–21, 1924	New York
Natl. Assn. of Stove Mfrs.	May 14–15, 1924	New York, Hotel Astor
Natl. Bottle Mfrs. Assn.	Last Wk. Apr., 1924	Atlantic City
Natl. Glass Distributor's Assn.	Dec., 1924	Pittsburgh
Natl. Ornamental Glass Mfrs. Assn. of U. S. and Canada	June 24–26, 1924	New York
Natl. Paving Brick Mfrs. Assn.	Dec., 1924	
Penna. Gas Assn.	April, 1924	Atlantic City
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	May or June, 1924	
U. S. Potters Assn.	Dec., 1924	Washington, D. C. (?)
Western Glass and Pottery Assn.	June 15, 1924	Pittsburgh
Western Society of Engineers	June 4, 1924	Chicago

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

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Vol. 3 — May, 1924 — No. 5

EDITORIAL

COÖRDINATING RESEARCH AND TECHNICAL INFORMATION WITH PLANT CONTROL[1]

By J. A. Jeffery

Introduction

No industry can expect to enjoy prosperity and maintain supremacy over a period of years that depends on patents or secret formulae.[2] A wide awake competitor with research facilities will discover new and better ways of accomplishing the same results within a more or less limited period. A manufacturing enterprise must advance scientifically, but this cannot be accomplished without proper organization and equipment.

As a nation we are restless and ever anxious to work out new methods, in fact it is almost a national vice to discard the old and experiment with new ideas and devices. To a great degree our patent laws are responsible for this situation as they encourage inventions through profits that are expected to accrue from the monopoly they intended to create over a period of years; but there is a deeper instinct involved, that of industrial progress which is born in us.

It is unfortunate that we are so prone to take short cuts instead of methodically searching the literature that is so abundantly available.

[1] Presented at the Atlantic City Meeting, Feb., 1924. (General Session.)

[2] Italic is by the editor.

One of the saddest things we can imagine is to find a man laboring for months, or years, over a problem that has been worked out long before his time and which even a limited survey of text would have disclosed to him. The average man seems possessed with the thought that a clever idea he may have conceived is new and worthy of protection through patents, and it is to be regretted that so many Patent Attorneys encourage such clients and that the Patent Office in turn issues such an endless chain of worthless patents. However, this difficulty is not confined to the individual, for many industrial organizations are spending great sums of money and valuable time in just such useless efforts through lack of a suitable research and engineering organization.

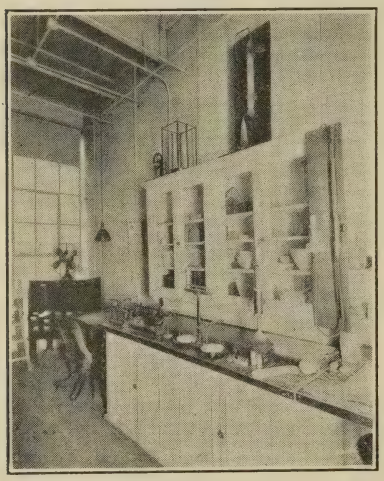

Fig. 1.—Ceramic laboratory. Preliminary tests are made here on all raw materials before accepting them.

It is well to lay special stress on the fact that *pure Research cannot be well conducted in a manufacturing enterprise by a single individual.* As a rule the results of this work would be almost useless to the business itself owing to the fact that a man mentally equipped to delve deep into nature's secrets, rarely has the engineering genius to put his discovery into workable form. Therefore, we should have in addition to the scientist or research worker, an engineering force capable of working out the practical application of the discovery or invention.

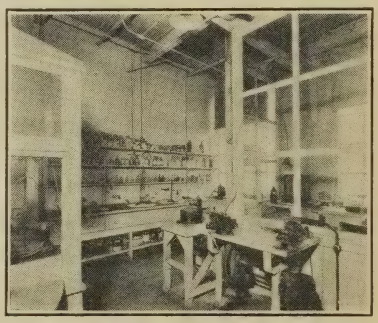

Fig. 2.—Chemical laboratory. All materials are analyzed at intervals. Every carload of some materials is analyzed.

Research Organization

In coördinating the research with production it is essential to have the organization so arranged, that coöperation is maintained. There must be someone in the personnel who is experienced in both the production and experimental work to such an extent that success will result when experiments finally become production problems. Here is one place particularly where a special department, such a one as our Process Laboratory which will be described later, plays an important part.

A well-planned research division in any industry includes first of all of course an efficient well trained personnel, whose activities are guided by a research director who *must* be a man of broad training and experience. And for successful research and plant control the necessary laboratories and departments must be available, and in our work we have found the following to be indispensable:

1—Ceramic Laboratory
2—Chemical Laboratory
3—Electrical Laboratory
4—Mechanical Laboratory
5—Testing Laboratory
6—Petrographic Laboratory
7—Library
8—Record and File Clerk
9—Legal Department

Conditions which arise in coördinating research and technical information with plant control are so numerous that it is very difficult to cover the entire field in a general way. Bearing this in mind it is the writer's

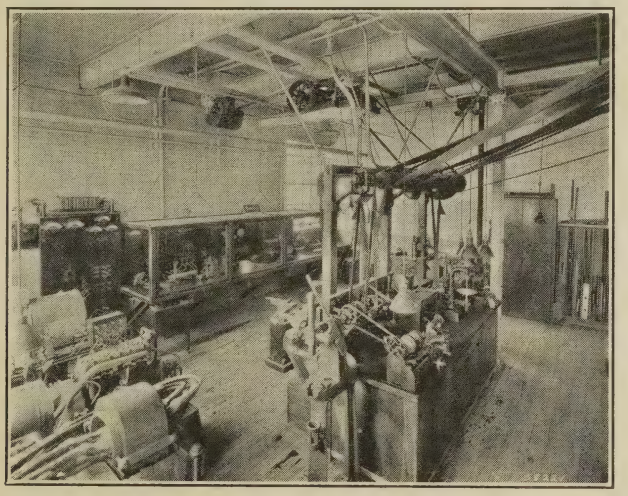

Fig. 3.—Electrical laboratory. Equipped for testing spark plugs, calibration of thermocouples and building of small electrical equipment if special.

opinion that he can accomplish more by presenting the details which have arisen in a ceramic plant. This is particularly so in this case as it is the ceramic industry that we desire to deal with.

Routing of the Work

All ideas, conceptions, or requests for information originating in the factory or within the Research Division itself, must be referred to the Director and by him assigned to the laboratory or individual best equipped to handle this problem.

ORIGIN OF THE PROBLEMS

Quite frequently the problem is so complex that several divisions must be called upon to solve certain parts of it, for instance—quite frequently it is discovered through the Sales Organization that a competitor has developed some radical improvement. Let us suppose this to be a porcelain article that is subject to tensile stresses. How then should this be handled?

THROUGH THE RESEARCH LABORATORIES

Experience has long since taught us that the microscope should be first employed and a careful examination made to disclose any new mineral that might have been used in the body, as well as to indicate the character of the porcelain as to grain fineness; degree of solution of the silicates such as quartz; the quantity and character of the crystal development; and the probable temperature of burning.

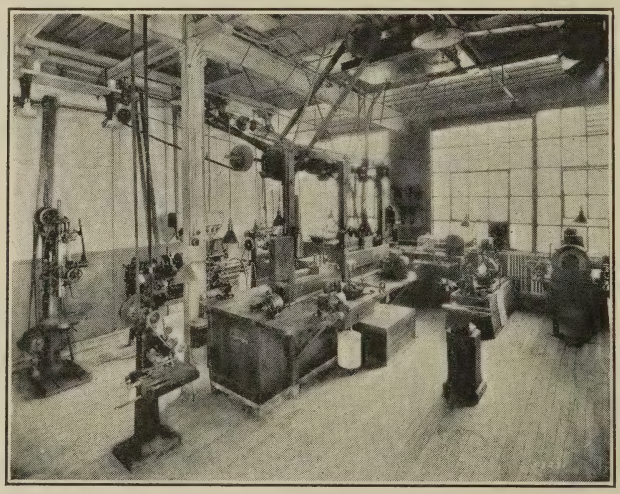

FIG. 4.—Mechanical laboratory. Many special machines and instruments are made here.

The Petrographer would then report his findings to the Director, and in turn the Chemical Laboratory would be called upon to make a complete analysis; then from its results, the Ceramic Laboratory would be called upon to reproduce the body or porcelain of like character and improve upon it if possible.

Obviously, if the porcelain is to be fabricated in the form of an insulator we must now call upon the Mechanical and Electrical Laboratories to make tensile and shock tests on the finished article, as well as to establish the electrical values at atmospheric and elevated temperatures.

In an industry of considerable magnitude it is evident that a large staff is necessary to carry on consistent research and at the same time take care

of manufacturing problems as they arise. As a matter of fact if a highly specialized product is made, not only careful physical tests of raw materials are necessary but accurate chemical analysis of nearly all raw materials is absolutely essential. Not less than two men should be steadily employed in the work of checking raw materials.

The Process Laboratory

Let us now assume that it is desirable to put a new body or formula into production. At first thought this seems a simple matter, but it frequently takes at least a year to iron out many of the problems that arise when we attempt operations on a large scale. In our industry a multiplicity of troubles arise from the complex nature and properties of the matter we know as clay and the peculiar reactions that take place in burning.

Fig. 5.—Testing laboratory. All plant control tests on production ware are made here, such as impact, thermal shock, electrical resistivity at increased temperatures and the like.

The difficulties involved in introducing a new body into full production in the factory led us to equip what is known as a Process Laboratory, the function of which is to prepare and fabricate the new composition on a small production scale. As a matter of fact this laboratory is a small yet complete manufacturing plant itself, equipped with full-sized units which are exact duplicates of the factory equipment including mills, pugs, forming machines, glazing machines, kilns, etc. Obviously the new body can be then produced in considerable quantity over a period of time sufficient to permit accurate study of its behavior and the effect of different lots of material, as well as its behavior over the full range of burning temperatures.

During this period accurate records are kept of the speed of operation and the percentage of good ware produced, as well as average mechanical and electrical values. If possible, the body is adjusted to give the same shrinkage as the body in production in the factory. If this is not possible,

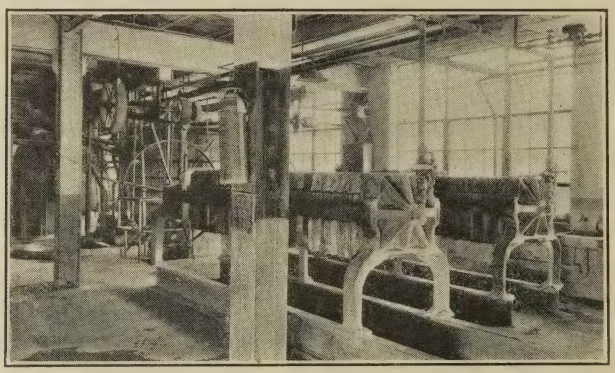

Fig. 6*a*.—Process laboratory slip house containing six-foot pebble mill, blunger, lawn, magnetic separator, filter presses, etc.

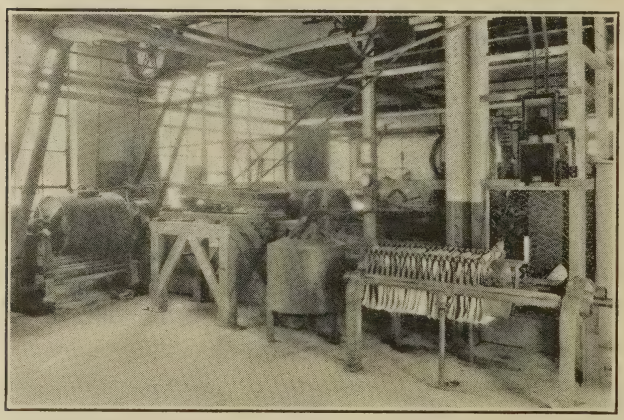

Fig. 6*b*.—Process laboratory slip house containing thirty-inch pebble mill and other necessary equipment of proportionate size.

then all dimensions are accurately worked out so that the equipment can be altered to conform to the new shrinkages.

In the usual order of events radical composition changes are not frequently necessary and the continuous employment of a trained Process Laboratory force would not be warranted. However, there is another and more important function performed by this department.

Function of Process Laboratory in Quality Control

In the manufacturing of a highly specialized product it is essential to rigidly control the properties of the porcelain body and this is best accomplished by preparing the body in 40,000 lb. dry-weight batches which are stored in separate masses after weighing, milling, and filterpressing. Within a day or so after the body has reached the aging cellar a few hundred pounds is

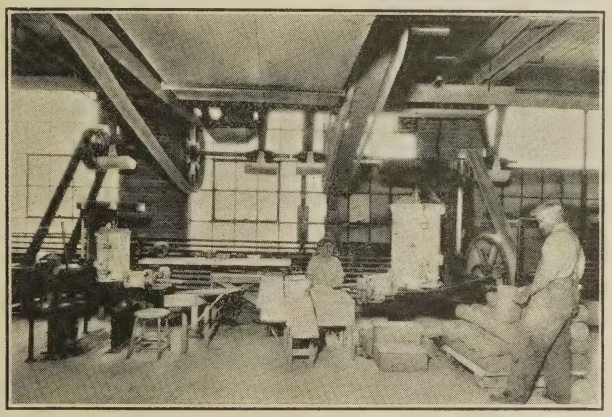

Fig. 7.—Process laboratory containing one full production size pug mill for blanks and one-half size.

withdrawn and taken to the Process Laboratory where it is pugged, dried, formed, glazed and placed in specially marked saggers which are burned through the tunnel kiln, then returned to the Process Laboratory for final inspection and tests. If this lot of porcelains passes all standard tests, the 40,000 lb. batch from which they were made is released to the Production Division; but close check is advisable and if practical, each batch should be traced through the Production Division and at least one piece of the finished product, and more if the article manufactured is small, should be selected from each kiln car or sagger and subjected to final tests. The final tests should in no case be trusted to the Production Division, for as a rule the latter is only seriously concerned with quantity and can hardly be expected to watch the quality.

Fig. 8.—Process laboratory. Turning department equipped with six standard sized machines and independent means for catching the body dust.

Importance of Patent Protection

One of the most important responsibilities of the Director of Research in a modern industry is to protect the work of his division through patents. Too much emphasis cannot be placed on the necessity of great care in selecting proper legal advice. A Patent Attorney should preferably be selected who has had not only a wide experience but one who has specialized in the particular industry with which we are concerned. To be competent to handle the legal end of such an industry as ours, he should have a fair knowledge of engineering and chemistry and must familiarize himself with much of the ceramic literature and foreign patent art.

Fig. 9.—Process laboratory. Automatic glaze spraying machine. One operator puts the unglazed green cores on the revolving spindles. These pass by the atomizers and are coated with glaze, removed by the other operators and placed in saggers.

If proper steps are not taken to protect inventions that originate in the Research Division or that are worked out from suggestions from the factory, it would be difficult to show that any results have accrued from the activities of this department.

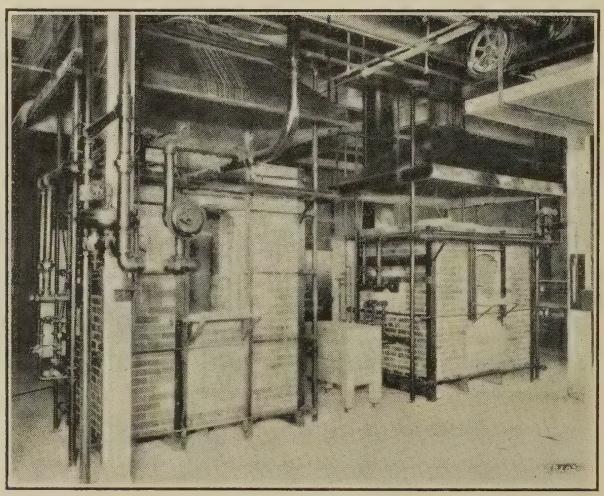

Fig. 10.—Process laboratory kilns. One will hold 1200 cores, the other half that amount. Ordinarily all tests are put through the production kilns.

Secured Assurance of Benefit from Acquired Knowledge of Employees

As a rule the men who are employed to carry on the work in the Research Laboratory are selected for their particular ability or education. Generally they take the position expecting to seek a better one after having had the benefit of practical training and experience. The realization of this often is a severe disappointment to the employer, but on the other hand the type of man that is valuable in research work and to his department is almost certain to be ambitious and restless for further experience or advancement. Obviously, then the benefit of their work would be lost were they to leave the organization to take a somewhat similar position with a competitor. It is easy to see how the results of much of their work would then pass directly into the hands of the new employer who is probably provided with means and equipment to reap the benefit of their work to the detriment of the concern that had made their former activities possible.

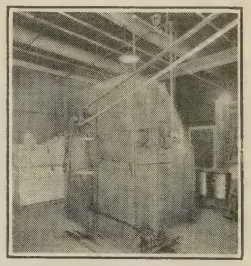

Fig. 11.—Process laboratory dryer equipped with automatic control.

Protection against Unfair Competition

It is a well known fact that there are many manufacturers who do not hesitate to prey upon and pirate ideas that are the property of others, actually believing they have shown keen business ability in so doing. It is fortunate, however, that the courts now frown on such tactics and it is becoming less difficult to establish the fact of unfair competition or intent to defraud. Patents, however, are not our only protection and the possibility of even more adequate protection through design patents and trade marks should not be overlooked. Infringement of patents is sometimes difficult to establish, whereas, unfair competition or intent to defraud the public is much more easily proven and in some instances the Post Office Department can be called upon to punish the offender and thus protect both the manufacturer and the public.

Fig. 12.—Plant control tests. The impact test is made by dropping a weight a definite distance onto the end of a porcelain core held horizontally in a firm position.

PATENT RIGHTS OF EMPLOYER AND EMPLOYEE

Before a man is employed or added to the staff of the Research or Engineering Division of a modern industry, the importance of protection should be explained to him and he should be required to sign a suitable and fair agreement to convey the title of all inventions to the Company that employed him, thereby saving both parties much annoyance and expense as well as endless argument, should a dispute ever arise. It is not pleasant to have legal actions arise from lack of a clear understanding of a man's duties and the purpose of his employment. It is easy to assume that he is attached to the Research Division for the purpose of improving the product, and equally reasonable to assume that inventions thus created or conceived belong to the employer, but it is another thing to prove this if suitable documentary evidence is lacking. In the case of a disgruntled employee it is surprising how he will try to evade responsibility and claim that an invention or conception is his property and only shop rights belong to the employer.

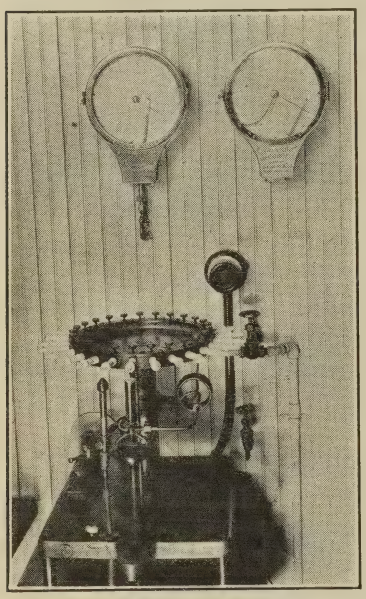

FIG. 13.—Plant control tests. The heat test consists in suddenly exposing the end of a cool porcelain to the flame of a meeker burner and leaving it there for 60 seconds. All conditions as to temperature, time, etc., are accurately controlled.

The writer sincerely believes that these relations should be thoroughly understood and the agreement between the employer and laboratory worker be complete and fair to both, otherwise distressing arguments are certain to arise resulting in a direct loss to both parties, as cordial relationship should continue to exist after a man seeks a new position. From time to time an exchange of ideas may be of great benefit to both parties.

Duty of Research Director to Publish

There is another angle that should receive serious consideration for the benefit of the industries at large. *Until we have adequately organized and financed Research Bureaus that are supported by such industries as ours, I believe it to be the duty of the Director of Research in an industry to publish at proper intervals the results of research that cannot be considered an essential shop secret.* The publication of such matter through papers presented

before the societies representative of the industry in question, makes this information available to others who might otherwise spend much time and effort covering the same field. A good example might be cited as follows:

In the development of 18 and 19 cone bodies no small part of the problem was to find suitable kiln refractories and containers or saggers. Obviously, in this development many features were accomplished that will result in great economies in the 11-12-13 cone field, and the publication of such developments cannot injure the interests of investigators.

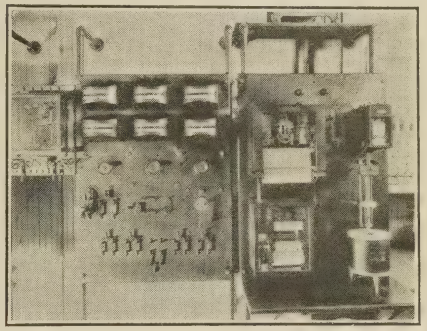

Fig. 14.—Plant control tests. The hot dielectric test determines the electrical leakage of the porcelain at increased temperature as well as the temperature at which the final failure occurs. All conditions must be constant and accurately controlled.

Less Secrecy and Greater Exchange of Information

In closing, the writer desires to plead for less secrecy and greater exchange of information and ideas. With a well organized research staff and modern laboratory equipment there is little protection possible through secret formulae. With an experienced petrographer, a capable chemist, and a ceramic engineer any porcelain article now manufactured can be duplicated if desired, hence there is little to be gained by secretiveness. No fair-minded man can expect to receive information if he is not willing to reciprocate.

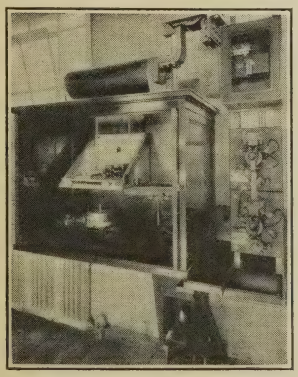

Fig. 15.—Plant control tests. Equipment built in our own laboratories and designed to determine thermal expansions up to 1100 °C.

Value of Broad Training

The Schools and Colleges should encourage the young ceramic engineer to gain the broadest possible experience along other lines of engineering, particularly those applied in our ordinary manufacturing plants. There is an old saying that the most uncommon thing in the world is common sense, but we can truthfully state that men capable of assuming the duties of Research Director or Plant Manager in the modern progressive ceramic industry are as scarce as the proverbial

"hen's tooth." There is a fine field for rapid advance with unusual monetary compensation for the men with wide practical engineering experience and good knowledge of works control.

THE CHAMPION PORCELAIN CO.
DETROIT, MICH.

PAPERS AND DISCUSSIONS

ECONOMIC FACTORS THAT MAKE RESEARCH IN INDUSTRY IMPORTANT[1]

By William R. Mattson

What I wish to bring to the members of the American Ceramic Society is the relationship of general business to research and also a few points as to just how we can tie up the ceramic industry to general business. The objects of this Society and the objects of the organization which I represent are more or less the same; that is, you are all interested in the improvement of industry and the improvement of business, and we, by our studies of economic conditions, wish to help business in a general way and industries in a specific way as far as we can. I first want to discuss a few general problems and then something of a more specific nature.

American industry has developed to such an extent that an analysis of even surface conditions shows the importance of research in business.

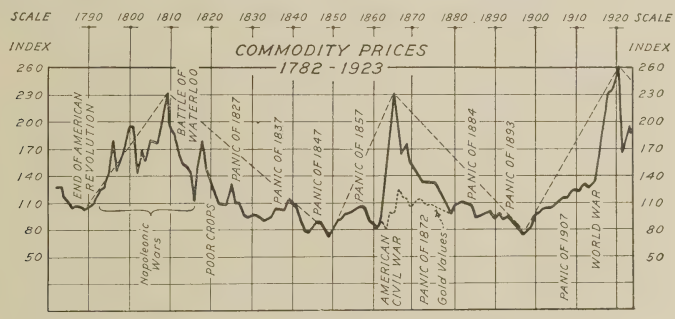

Fig. 1.

Fundamental changes during the past five years have developed numerous economic factors that indicate that business is in that stage where research is of the utmost importance.

Business is still experiencing the effects of those years of expansion and inflation, during and immediately after the war. Although many manufacturers and business men feel that we are now back to normal, you will note numerous changes during the next few years that will be directly attributable to this inflationary period.

Take, for example, the matter of commodity prices. Over a period of approximately 150 years, commodity prices have experienced three major periods of inflation and the same number of depressions (see Fig. 1). It is interesting to note that the increases started from fifteen to twenty years before the peak was reached. Each peak price was reached shortly after a war. Then followed a long period of commodity price decline usually

[1] Presented at the Atlantic City Meeting, Feb., 1924. (General Session.)

starting with a very decided reaction. We are all familiar with the trend of commodity prices since 1920. Although I do not mean to state that present business conditions are directly comparable to those following the Civil War, it is interesting to note that commodity prices have declined about the same amount since 1920 as they did during the corresponding length of time following the Civil War. Now, the indications are that the long pull trend of commodity prices is downward. Of course, we shall note various fluctuations and an upward trend from time to time such as occurred during the winter and early part of 1923. Certain economists believe that we have reached a level which will be well maintained for some time to come. No matter which group is correct, the important point is that we are not facing a long trend rising commodity market.

Such a situation as this means that certain methods of business which prevailed during the period from 1910 to 1919 will not be successful during the next four or five years. A rising commodity market favors the business man who is a speculator. A declining market favors the conservative man who studies business conditions and takes advantage of the general trend.

The rising commodity market from 1900 to 1920 had the direct effect of stimulating industrial expansion. Furthermore, war demands were such that many of our major industries became over-expanded. This factor, as you know, has seriously curtailed industrial building during the past four years. Although this handicap is being overcome in many lines, it is still a factor that must be considered in the industrial outlook. Probably the shipbuilding industry is the outstanding example of this condition.

This heavy capacity means that competition is unusually active. To meet this situation, manufacturers must keep their costs and prices low in order to maintain a good volume of sales. Without a doubt, the reduction of costs demands effective research of a technical and economic nature. The study of efficient distribution is still in its infancy and considerable research work must be done in this field by successful business men during the next few years.

The cost of production in many lines has been steadily declining. Intensive research work has been done in this field. The cost of distribution on the other hand, has been steadily increasing. It is much easier to manufacture goods at the present time than it is to dispose of them. The most successful manufacturer or distributor during the next few years will be the one who applies research work to his problem of distribution as well as the problem of production. In practically all industries, costs can be cut by better methods of distribution.

The business outlook for the rest of this year also indicates that real intensive economic research will be necessary in order to maintain a reasonable amount of profit. We are now in what might be termed "a normal

zone of business." There is little probability that we shall experience any radical fluctuations such as have been noted within the past five years. There are numerous bullish factors that might be mentioned which would indicate that the outlook for business this year is especially good. Transportation has been active and the railroads are in fairly good condition. Employment was heavy throughout the greater part of 1923, wages were high, and the spending power of the public is now good. The 1923 income of the farmers was better than in either of the two preceding years. Money rates are low. Building activity has been large and the indications are that 1924 will be another fair building year.

Offsetting these factors are certain bearish conditions. Expansion has been unusually rapid in many industries and the probability is that some of them will be forced to curtail production this year. Prices are still somewhat out of alignment. In many cases, goods are so high that buying is very conservative, with no likelihood of an improvement until lower levels are reached. Furthermore, the foreign situation is of considerable importance, especially in such lines as the ceramic industries. The general outlook for individual industries depends on the extent to which those industries are affected by the economic factors just mentioned.

Now just how do these general statements apply to the ceramic industries? Just why is it necessary for manufacturers in these lines to pay particular attention to research work? In the first place, the general trend of the ceramic industries is comparable to the broad changes in business. A direct comparison of the total value of products of the various branches of the ceramic industries with the Babsonchart clearly shows the close relationship (see Fig. 2). This chart also shows that a further readjustment in business would undoubtedly mean further changes in the ceramic industries. Consequently, the manufacturers in these lines should first pay special attention to the trend of general business in estimating what is ahead for their business.

On the basis that the long pull trend of commodity prices is downward, it is evident that ceramic manufacturers must study the methods of reducing costs or else have their profits reduced. In meeting this condition, these studies should develop along two main lines. In the first place, continued research should be made for improvement in manufacture. An analysis of these problems comes under the direction of the industrial engineer. In the second place, special attention should be paid to problems which are exterior to the immediate details of the business but which have a decided effect on the profits of the concern. These include a study of general business conditions and the factors in general business which are directly applicable to the ceramic industries. The trend of demand, prices, competition within the industry, and competition with foreign manufacturers are all of extreme importance.

A study of demand in this industry shows that the trend should be more or less continually upward. The products of the ceramic industries are of universal use and there is no reason why the total consumption should not increase at least as fast as the population. Certain lines which are directly used in building, of course, will follow the fluctuations in that industry. The long pull trend, however, should be upward. Such yearly fluctuations as will occur in demand will probably be directly attributable to and comparable with the changes in general business.

A detailed analysis of the industry shows that competition among domestic manufacturers is becoming especially keen. This industry has probably reached its saturation point and there is little doubt that capacity is more than necessary to supply a normal demand. Statistics for the clay products industry reported by the Census of Manufactures show that the number of concerns is tending to decrease. Twenty years ago, there were 5,500 establishments reporting while the value of products was given

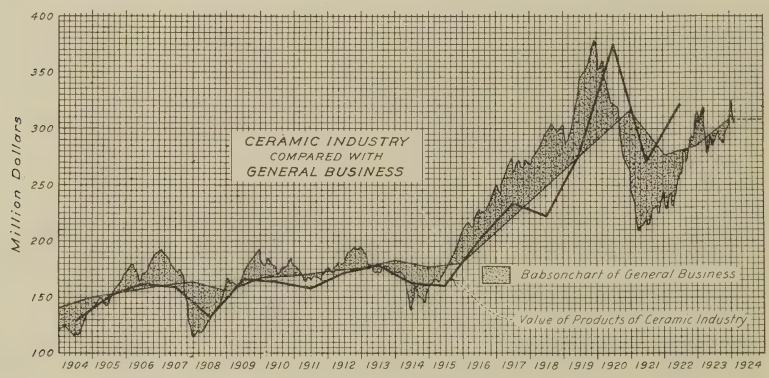

Fig. 2.

as $135,000,000. Each census year showed a decline so that in 1921 there were 2,150 establishments reporting but the value of products had increased to over $278,500,000. The number of wage-workers has decreased from 118,000 in 1904 to 97,000 in 1921. It is interesting to note that in 1909, there were approximately 133,000 workers in the industry. In 1919, there were only about 105,000.

In the various branches of the industry, we also note a decline in establishments. In 1914, there were 350 pottery concerns reporting, whereas in 1921, these had decreased to about 270. The manufacturers of brick, tile and terra cotta in 1914 numbered 3,239 and these had decreased to 1,880 in 1921. The number of workers also declined. These changes are probably due to the gradual elimination of the weaker concerns, the invention of labor-saving machinery and also foreign competition. We see no reason why the trend indicated during those years will not continue.

At the present time, probably the most important external problem in the industry is foreign competition. This factor was of importance before the war and may have been one of the principal reasons for the decrease in the number of concerns from 1900 to 1914. With the curtailment of imports during war years, the industry was materially increased. The increase in the value of products in the clay products industry during the five-year period 1909 to 1914 was from $168,800,000 to $172,800,000, an increase of only $4,000,000. In 1919, however, the value of products amounted to $283,300,000 or an increase of nearly $111,000,000 from 1914 to 1919. We realize that a certain amount of this was due to price inflation but the actual volume of products also undoubtedly showed a very heavy increase. However, throughout the five-year period, the number of concerns in the industry showed the same tendency to decrease which was noted throughout the pre-war years.

A study of import statistics shows the trend of foreign competition. Imports of clay products were decidedly restricted during the war years but since then a steady increase has been noted. In the case of pottery, for example, the value of pre-war imports amounted to approximately $10,000,000 annually. This decreased to about $5,600,000 in 1916 but since then has been steadily increasing. In 1920, the imports of pottery amounted to $10,000,000 and in 1923, the imports were well over $16,000,000. The increase has been especially noticeable in decorated chinaware and decorated earthenware. In the former case, the value of imports has increased from about $3,000,000 in 1916 to about $7,500,000 in 1923. Decorated earthenware increased in this period from $1,700,000 to nearly $4,000,000. The indications are that this upward trend will be continued despite the present tariff regulations.

Special research work will have to be done to meet this foreign competition. It is doubtful whether producers in this country can compete on labor costs with those abroad. Living conditions are different and unit wages are very much less in the principal ceramic producing countries in Europe. Consequently, it seems that the American producers must meet this situation by the production of more efficient machinery. They must also improve the present methods of distribution in the domestic and foreign markets. The indications are that the foreign producers will be able to win out on the grade of ceramic products in which labor cost is the most important factor. Manufacturers of machine-made grades should be able to build up an American market in which they will be able to compete successfully with foreign producers.

The tendency in price will be downward. Statistical data as to prices in the industry are very incomplete. However, government figures show that certain grades of chinaware are now over 125% above the pre-war level. The price index of all commodities is about 60% above the 1913

base. Advertising should be increased and should be more efficient. Special study should be made of transportation costs which is a very important factor in the industry. Furthermore, better trade information should be available. Data pertaining to the fundamental factors of the industry are very incomplete. This may be due to the complexity and variety of the products of the industry. Possibly a decided saving could be made by a better standardization of products. Many of our important industries are now devoting special research work to the elimination of unnecessary and unprofitable lines. Numerous other factors might be mentioned but the indications are that most of these would pertain to the problems of distribution.

The ceramic industries are essential to the United States and, if properly handled, should be able to successfully meet their foreign competitors. There are, however, numerous problems which must be studied. The future success of the industry depends on the solution of these questions. The best method, in fact, the only method of meeting these conditions is efficient research. This must be devoted not only to the detailed problems of production, but also to the many and complex problems of distribution. The general outlook for the industry indicates that the manufacturer who follows these lines should be prosperous and enjoy good business despite the numerous problems that are ahead.

Babson Statistical Organization
Wellesley Hills, Mass.

THE INVESTIGATION OF TERRA COTTA WORK AT THE BUREAU OF STANDARDS[1]

By Eckardt V. Eskesen

ABSTRACT

Research is being made covering failures due to popping, grazing and spalling. This work has been going on for nine years, first under the direction of Professor Bleininger, and later on under Professor Bates.

One or two fellow Ceramic Engineers have been constantly engaged in this work. Various tests, such as freezing and thawing have been conducted for the purpose of testing different clay bodies and glazes submitted by the manufacturers.

I have been asked to say a few words in regard to the investigation of terra cotta work now going on at the Bureau of Standards at Washington. As I am not a ceramist myself, I will not be able to go into details or enlarge on the methods employed and the different tests conducted at the Bureau of Standards. Others present here may be able to do this much better. I can only talk about the subject in a general way and try to outline to you the benefit which our industry may in time derive from this investigation.

[1] Presented at the Atlantic City Meeting, Feb., 1924. (General Session.)

The work at the Bureau of Standards has been carried on for some eight or nine years at some expense to the Society, and at great sacrifice to the heads of the Bureau, who have in every way possible accommodated and assisted us in our work, and have given much time and study to directing this research work. I wish to say here that the Bureau of Standards is greatly interested in our problems and is enthusiastic about carrying out this research work to a final conclusion.

In every industry there are problems and troubles which are constantly popping up. Nothing is perfect. We must progress and while we are progressing we come in contact with new difficulties. New machinery and new methods have changed conditions and it is no more the old way of production.

So in the terra cotta industry—a comparatively new industry in this country. The pioneers who first opened up the road and introduced terra cotta to the American architects were not confronted with the problems which confront us today. They had other problems naturally, such as getting a suitable clay, uniformity in colors, etc.

At that period the building construction consisted of solid masonry. The terra cotta was carried in the wall on its own bond, very seldom any iron or other material being used for support. There were no failures of terra cotta then. You can go out and look at these jobs produced thirty or thirty-five years ago. Some of these buildings are still standing and the terra cotta looks as good as new, or as if it were made yesterday.

This was before the period when sky-scrapers came into being. With the sky-scraper also came into use the iron and steel construction, and later on the concrete construction; so today we have what is called modern American building construction, meaning that all the construction going on today outside of residences and small dwellings, is erected in concrete or iron and steel.

With the introduction of the sky-scraper and the concrete building, came before us the problem of how to adapt our material to the changed conditions; how to support a load of terra cotta, which now under the changed conditions, is used simply as a veneer on the front of the building, and how to hang the projecting courses, and tie down the tiers of ashlar work.

Before the period mentioned by me the range of colors put into the market by terra cotta manufacturers had been very limited. To start with in this Country the colors only consisted of red or terra cotta colors; then came a period where the cream color or fire flash colors came into use; later on nothing but gray colors were used, and with very few variations away from that rule. At this last stage of development, architects and manufacturers, seeing the desirability of getting away from the monotony of plain colors, started experimenting in glazes and colors, and a very

healthy demand was created for a wider range of colors and finishes, thereby giving new life and beauty to the modern American building in the transition from old to new methods. A period lapsed during which terra cotta, was trying to adapt itself to new conditions. Its use was greatly increased and architects, leaders in the profession, recognized the material as the one best adaptable for use in modern building construction, yet it was natural that there should, considering that the industry was itself in a state of transition, be shortcomings. It cannot be denied that there have been failures in terra cotta. We have all heard of them. Of the one hundred and one good jobs that were delivered in first class order and still stand up and are still attractive, we do not hear of; but the one bad job which failed is today an eye-sore and everybody is talking about it.

The problems which troubled us years ago are still troubling us. Conditions are constantly changing, and so today, as it was yesterday, the question is, if we must eliminate defects and failures, to adapt our material to the changed conditions. It is among others a question of proper construction; it is also an engineering question; a question of how to build so as to protect our product from the ravages of moisture and changing climate. It is also an important question for the ceramist to solve, a question of how to perfect the quality of the material, so that it will resist these climatic changes.

It would seem plausible to say that a material like ours which is burned from 1800° to 2200°F and covered with an absolutely impervious coat of glaze or semi-glaze slip, can stand up for thousands of years without changing, and so it can, if it were not for the fact that moisture through the joints or from the wall surrounding our material gets into the bond of our material and seeking the natural way of getting out again breaks through the surface, thereby causing what we call spalling and chipping, etc.

Another class of failure in terra cotta which we all well know is the breaking and chipping caused by contraction and expansion due to sudden changes in climate. We are up against a problem of adapting our material to the many varieties of severe climatic changes as we find them in the United States, where the climates range from the cold of the polar region to the heat of the tropics.

It is up to us terra cotta manufacturers to find a way of overcoming these difficulties, to solve the engineering problems, to make a material which will permit certain contractions and expansions. We must prevent moisture getting into the inside of our material and we must make our body and our glazes and slips so that they will act together. We must deliver a material which will not show cracks or crazed surfaces before or after being delivered to the building. It is with the idea of finding the proper body and the proper surface and slip, both of which will act together, that the work is now going on at the Bureau of Standards.

We are all, each for himself, constantly engaged in this work trying through our Ceramic Departments to solve these problems. But it was recognized that the question was not a question which could be entirely solved by the individual members; that considering the before-mentioned wide range of climatic conditions in the United States and considering that the manufacturers of terra cotta in the United States are scattered from east to west and are employing different methods in trying to arrive at a more perfect result, it was thought that by the investigation going on at the Bureau of Standards, the manufacturers would be able to arrive at a conclusion which could not otherwise be arrived at, or solved individually.

The work which has been going on at the Bureau of Standards consists of testing the burned material delivered by the different companies right along, and extended tests have been carried on as to the strength of the different materials, the breakage point, the porosity of the body, its coefficiency as regards the glazes. One of the tests being carried on at present consists of alternately submerging and freezing and then heating the pieces.

It is not up to the Bureau of Standards to tell us where we are right or where we are wrong. The Bureau will not be able to more than point the way, and it is up to the individual manufacturer to make his own deductions from the investigation made by the Bureau of Standards and form his own conclusions, and use the advice given him so that he may perfect his material.

There will, perhaps, never be any final result or conclusion as to the question whether a hard body is better than a soft, or a material burned to a very high degree of heat is more endurable than a somewhat lower burned material. It may be a question of the quality of the clay used, and the elasticity of the slips, either of which may be just as endurable as the other.

I have confidence, however, that the work done by the Bureau of Standards is of great value to the terra cotta industry, and that it will in the near future assist us in solving some of our problems. It is up to our ceramist from the wide knowledge gained through the investigation to make his own deductions and make same applicable in a practical way so as to fit the particular situation within his company.

New Jersey Terra Cotta Co.
New York City

REFRACTORIES QUESTION BOX

By E. E. Ayars

Questions

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire-clay brick to spalling?

2. What difference is there between the properties of a soft mud machine made and a hand made brick?

3. What is the best method of sampling fine ground fire clay for testing? Discuss straight clay and cement mixtures.

4. Can a customer form any judgment of the quality of a shipment by a test made on one brick? If not, how many samples should be used?

5. Can an iron free clay brick be made for blast furnace service?

6. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?

7. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?

8. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand made fire brick?

9. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?

10. What is the reason for the more rapid failure, at a lower temperature, of fire brick subjected to reducing atmosphere, than will obtain with the same brick under oxidizing conditions?

11. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

Question

Is laboratory control possible in the manufacture of refractories?

Discussion

"Laboratory control is being practiced in the manufacture of refractories. The extent to which such control is being used varies, from plant to plant, the particular grade of product being manufactured ofttimes being the determining factor.

"Fusion and burning tests made on various strata or veins of clay make it possible to determine whether or not certain sections in a particular vein should be used in any particular product. Accordingly, as far as the control of the finished product is concerned, it is possible to use the proper selection in mining and grading of the raw materials.

"In respect to laboratory control of the actual fabrication of the raw materials in the finished product, such tests as screening, dried strength, drying and burning shrinkage, give a check on how closely the specifications of manufacture are being carried out. This question rather implies

its own answer and while laboratory tests do not insure first class product without the organization and equipment for producing it there is no question but that the industry would not have progressed as far as it has without the use of laboratory tests."—L. C. HEWITT, LaClede-Christy Clay Products Co., St. Louis, Mo.

Laboratory control of metallic alloys, and of iron and steel production, has long been so standardized and simplified that we saw great possibilities about three years ago in adapting that general procedure to the manufacture of our own "refractory alloys." In producing moderately large quantities of specially blended products there must be some controlling factor or there is danger of great variations in physical and chemical properties of the finished product. It is especially vital when there are perhaps fifteen active mixes being manufactured practically at all times, each one of these mixes differing in certain essential properties from any other mix. In order to retain satisfactorily the confidence of our customers in such products these respective physical and chemical properties must not vary beyond certain tolerances from one year's end to another. A purchaser must know that the properties which proved satisfactory a year ago will be retained within very close tolerances when he orders the same mix six months or a year afterwards.

As is known to many of us, an ultimate, or even proximate analysis of a refractory specimen is a time consuming, tiring job. Aside from the time involved and the cost of a skilled, reliable ceramic chemist the writer felt that adequate laboratory equipment and current supplies would be out of proportion to our own volume of production. There would be danger of its becoming a burden and serious delay especially since there is no point in having laboratory tests completed on production specimens after production has been practically finished. The time to draw specimens is when the blending of the mix is completed and then to devise quick, reliable and simple tests so that the laboratory report is available before that particular blend goes further into production.

It is a rather difficult task to devise, and then to set chemical tolerances without analyzing specimens thus drawn from production, but by requiring a few significant reactions on the specimen in a temperature range where its sensitiveness to chemical attack is at an approximate maximum, chemical control of production is greatly simplified and speeded up.

There is no such thing as absolute precision in the chemical or physical characteristics of any product made by Nature or man. Brief experience along the lines above suggested will set tolerances that are close enough and do not interfere with moderately large quantity production.

Laboratory control of the physical properties is so well known that it would be a waste of space to discuss it in detail. Frequently considerable

ingenuity is required in special cases, besides the routine tests for viscosity, ultimate fusion, gassing, etc., under perhaps both oxidizing and reducing conditions. As an example, it is necessary for us occasionally to determine the safe tension "fibre stresses" to which a certain finished product will be exposed. The penetrability of certain other products must be held in close control, where these products are to be exposed to various groups of fused, non-ferrous alloys, or slags, under various pressures.

Where many different components are required, such as in our own problem, laboratory control should start with the receipt of each raw component. These should be bought and accepted only on certain tolerances. Much time, labor, and grief will be saved by doing so. There are many producers who are after maximum possible tonnage of one line of product, with perhaps a "by-product" line made from inferior clays. To those manufacturers laboratory control will probably not appeal.

But to the producer of highly specialized "refractory alloys" it has proved itself not only practical after three years of operation, but in our opinion it is most essential.—T. C. Eayrs, Gen. Mgr. Massillon Stone & Fire Brick Co.

The following points on the question are taken from the discussion on the floor of the Atlantic City Meeting.

"I want to call to your attention a rather horrible example of the results of not following laboratory tests. I know of a brick manufacturer, who furnished brick for a power plant over a period of a good many years whose product seemed not to be as good as it was formerly. Upon consultation with him we found they made no chemical analysis themselves but occasionally had some made on their clay. The manager of this concern assured me the clay was of uniform quality because he showed me the analysis. I was much interested to note that sixteen years had elapsed between the tests he was discussing. It is no wonder that a good many things might happen in that time".—J. D. Carter, Philadelphia Quartz Co., Philadelphia, Pa.

"It seems to me the whole discussion has been merely on technical control of the raw materials. That is the simplest thing the refractories man has to deal with. I do not think many manufacturers today are not keeping fairly good check on raw materials. But that is only the beginning.

"We spoil the brick in the process of manufacture. When we have a poor brick it is not due to fusion but something else, due to the manufacturing process. It occurred to me that was not what the questioner wanted to know—he did not want to know whether it was a good thing to analyze the clay; he apparently is interested in the process of manu-

facture.—A. F. GREAVES-WALKER, Stevens, Inc., Stevens Pottery, Georgia.

"In this question of control, there is one point that might enter into the control of the production. We have a simple method of taking twenty-four bricks from each kiln and testing those for weight, size and volume. We use a simple test to do that and then we correlate that with the results of our mining trip inspections, whereby we give each month the places to work and the amount of clay taken per day from each place. In that way we can control the water content by checking the screens. Fortunately any change in the size of the screen will very soon change the water content. In dry press ware your screen size is pretty close, your water content cannot vary much and get a good brick. So we have three places in the process that we control."—(A MEMBER.)

"It would seem that if laboratory control is to be exercised anywhere it could be exercised by the manufacturer. You can take a single clay, for instance flint clay, and establish certain standards and live up to these standards for that clay. You can take your plastic clay and build up to a certain standard there and by regular checking know how closely you come to those standards. It does not appear, however, that anyone can say just what the true control would be. Probably our mixtures are not what they should be. Perhaps we do not always hit it in the right spot in the brick—it may be that the clay is not uniform. It might be the water content, for example. Perhaps if anyone were to condemn laboratory control, it might be because of the fact that they used the wrong method. It seems to me that it is the misapplication of the test rather than the failure of the test itself."—RAYMOND M. HOWE.

The question of laboratory control in the manufacture of Refractories, as stated, may have many applications. The Editor chooses to believe that the thought in the mind of the man who put the query should have been stated as follows: Is it possible to secure uniform quality and uniform size in refractories by the application of laboratory tests?

Within recent months the matter of uniformity has assumed a new light and all manufacturers recognize the importance of producing refractories which vary in size and quality only the smallest conceivable amount. Such production will in most cases require the further development of processes and the installation of additional equipment. It will mean added cost of manufacture but the consumer has long since indicated a willingness to pay a premium for a brick that would lay up with uniformly thin joints and give uniform service. However, many consumers will undoubtedly consider the manufacturer of uniform brick offered at a premium in the same class with the renowned Jesse James, but it is

economically impossible to give something for nothing. Uniformity in a refractory will add to the cost, but at the same time the consumer will enjoy a lower unit cost and many will take advantage of this. More and more refractories are being purchased on service instead of price only, as formerly.

It would not appear possible to regulate the uniformity of fire brick produced by the present methods, by the simple application of laboratory control methods.

The matter of fusion point and chemical analysis may be regulated in the control of the raw materials, but it is the slight variation in the character of different carloads of raw materials, and the considerable variation in process treatment from day to day which accounts for the lack of uniformity in the product.

It is taken for granted that any manufacturer considering laboratory control methods has first thoroughly prospected his mines and has plotted the different seams of clay from core drill analysis.

His attitude then in selecting his clays at the mine should be that of the man buying material on specifications, and every possible precaution be used in the mining, grading and loading to see that materials are up to a certain standard.

Given an intelligent control of chemical analysis of the raw material and the exclusion of all foreign matter it should be possible to so regulate the processes that further laboratory control was almost unnecessary.

In the February number of the *Journal* appeared a description of material handling and storage methods designed to secure uniformity in an electrical porcelain body. The system of bin storage is designed to care for from 360 to 450 tons of material while an open storage system capable of handling 1000 tons or more is described. In view of the large tonnages represented in the daily capacities of refractories plants it is probable that the open storage system would be most effective and least expensive. In choosing such a method it is important that adequate measures be taken to protect the open storage from foreign material, and all through the process dirt and such refuse as grease, etc., must be kept out of the material.

In some cases it would undoubtedly prove advantageous to put all plastic clays through a rotary drier before placing in storage.

Assuming that the matter of uniformity in the raw material is taken care of in mining and by adequate storage and handling methods, the process of grinding, screening and mixing presents a problem. Tramp iron and some iron from the mills and pans may be removed by a magnetic pulley. The screen sizes may be checked occasionally by screen analysis and erratic separations avoided by regular replacement of worn screens.

Proper grain sizes of grog and plastic clays should be determined according to behavior in service. These should be strictly adhered to and will not affect the process in any way except to indicate the type of grinding and molding treatment, *i. e.*, soft mud, stiff mud, dry press, etc.

The matter of mixing or tempering is important. It may be determined by trial whether the body is improved by double or triple milling or pugging. If the tests indicate three pug mills or additional wet grinding equipment for the preparation of one charge of brick mixture, the method should be altered to take advantage of the indicated improvement.

Moisture content is of great importance. The poidometer is used with marked success in measuring the amount of water fed to the brick mixture. In many cases they have been adjusted so delicately as to compensate for the moisture already in the clay. One of the most pregnant causes of variations in uniformity of fire brick is the hand of the "experienced" pan man or pugger on the water hydrant. The operators' judgment is never equal to the situation. Although a man may be able to produce a good column from his position at the pug mill, the limits within which a good column obtains may permit a variation of several per cent of mixing water. The writer is not convinced that the poidometer is the final answer but it is many steps ahead of the manual method.[1]

Molding methods are sometimes at fault. A variation in density and workmanship is often seen in brick produced at different hours of the day by the same hand molder. When hand molding is necessary and the clay comes to the molder in a uniform condition from time to time, it is not possible to jar the mold by some mechanical method, the effect of which has been predetermined, in order to eliminate the indifferent treatment of a tired molder.

In the case of stiff mud brick the auger speed, depth of die, die lubrication, repressing pressures and method of hacking on drier cars should be studied. The correct condition will vary with each type of clay or mixture.

Dry press pressures are variable but there is a correct pressure for each type of brick. The addition of pressure gage equipment to the dry press is indicated. Moisture of dry press mixtures should not vary and methods should be devised, in the study of grinding and mixing, to secure uniform tempering.

The determination of the cross-breaking strength on green brick will indicate the uniformity and homogeneity of the mixture. Variations in water content, grog content, size of grain and molding density may be noted. This test should be conducted on a set plan with respect to drying conditions and time.

Correct drying will have little or no effect on uniformity. Rapid drying often produces unsound brick and these are not marketable. The

[1] See "Question Box," *Bull. Amer. Ceram. Soc.*, 3 [3], 90–93 (1924).

practice of leaving hand-molded and repressed brick on the floor long enough for them to get leather hard and immediately setting them in the kiln is open to criticism. In this case most of the water that should come out in drying comes off with the water smoke. With some clays the excessive moisture during the water-smoking period softens the brick enough to change its size and shape. Such effects should be guarded against. Kilns are not efficient or satisfactory driers but there are many plants now employing this method.

Setting methods may sometimes be changed to eliminate kiln marked or misshapen brick, and thus reduce kiln losses.

Proper firing conditions should be determined and a regular schedule followed. Kilns will require redesign and rebuilding in many cases and regular repairs must be made so that proper firing conditions may be maintained. Overfiring of the ends of Newcastle kilns and of the rim of round down draft kilns may be eliminated by a study of local conditions. Some remedies may be found in the following list; redesign of kiln bottom, or fire boxes, change of coal or fuel, changes in setting method, setting farther away from bag walls (from 2 to 6 inches) admission of excess air over the fire, etc.

In conclusion, the solution of the laboratory control problem is to first refine the manufacturing processes. Laboratory methods will aid materially in determining to what extent the refinement shall be carried, and simple tests may be devised to maintain control of the new methods.

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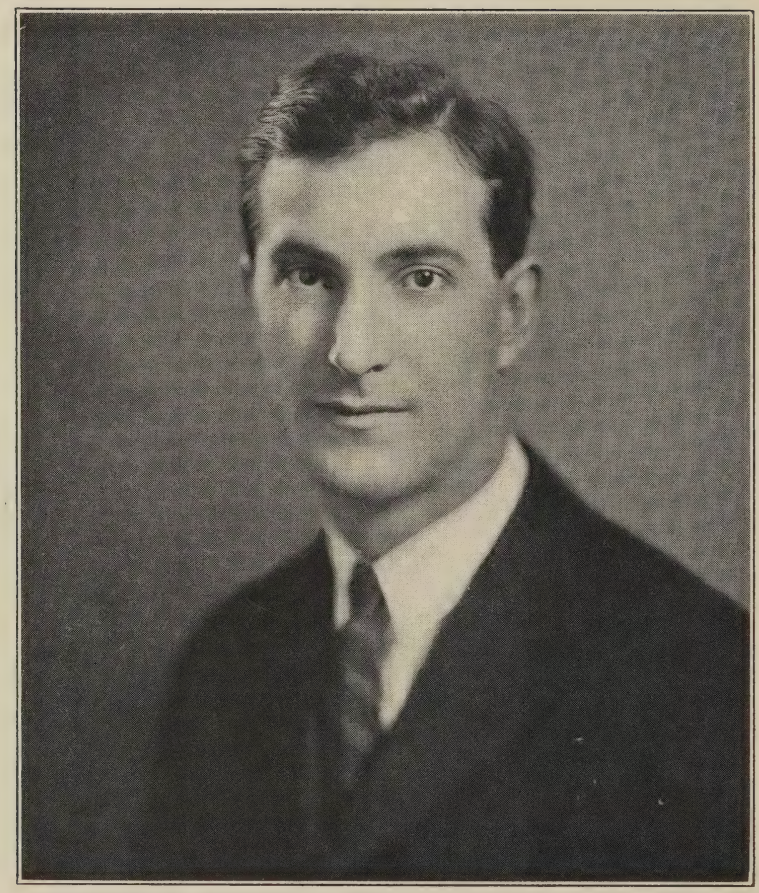

R. M. Howe

RAYMOND MILLER HOWE

The death of Raymond Howe on April 1 was a great loss not only to the many friends whose privilege it had been to know such a sterling man, but to the interests of ceramics in general. He was a specialist in refractories, but he had also broad knowledge of ceramics, and his warmly sympathetic interest in the profession and in the AMERICAN CERAMIC SOCIETY led to prominent activities on his part that will be missed generally. None, however, save the close friends who knew the rich treasures of his mind, as revealed in familiar conversation, can realize how great is the loss which ceramics has sustained in his death at the early age of thirty. For while Howe was a generous contributor to ceramic literature, there is a point of view from which it may be fairly urged that the work which rare and original minds fall short of doing because of brevity of life does never really get done at all. Something similar to it is performed, no doubt, but is done in a different order of causation; and though there may seem to be equivalence, the fact remains that, from the sum of human effort, an indefinite amount of rich and fruitful life is lost. True as this is in the case of science, it is still more obviously true in technology. Howe had an intellect that was outstanding from its happy union of acuteness with researchfulness. Very few ceramists were superior in balance of mind and in extent of literary acquirement. It is a bitter thing to lose a productive thinker of this mold, just in the prime vigor of life, and at a time when his ability was receiving recognition in industry as well as in the SOCIETY.

Raymond Miller Howe was born at Elmira, N. Y., March 15, 1894, the son of the late Mr. and Mrs. H. C. Howe. He received his preparatory education at Riverside School and the Elmira Free Academy. He was graduated at Alfred University in 1915 (B.S. in ceramics) and then came to the Department of Chemistry of the University of Pittsburgh to pursue graduate work under Prof. Alexander Silverman. He received his M.A. degree in 1916, served as instructor in chemistry for a year, and was appointed an industrial fellow of Mellon Institute in 1917. While at the Institute, 1917–23, he was senior incumbent of the Multiple Industrial Fellowship sustained by the Refractories Manufacturers Association, a position that he occupied with distinction and in which he acquired an international reputation because of his published contributions to the literature of refractories. Early in his career at Mellon Institute Howe became active in the affairs of the Robert Kennedy Duncan Club, the organization of Fellows, and in the American Chemical Society (secretary, Pittsburgh Section, 1917), and the AMERICAN CERAMIC SOCIETY (secretary, Refractories Division, 1919; trustee, 1920–1924; vice-president, 1924). He served on the advisory committee of the War Industries Board during the World War and was an interested member of the American

Society for Testing Materials and of its committee on standardization of refractories. On April 1, 1923, Howe entered the employ of the Kier Fire Brick Company, of Pittsburgh, Pa., as assistant to the president, and shortly before his fatal illness it was decided by the directorate of the company to make him a vice-president in recognition of his technical and executive value.

Howe's first research was on the silvering of mirrors. His subsequent investigations related to fire brick, refractories, and underglaze colors. A list of some thirty of his published papers is appended to this necrology. At the time of his death he had in course of preparation a comprehensive treatise on "The American Refractories Industry," collaborating with J. Spotts McDowell, of the Harbison-Walker Refractories Company, of Pittsburgh, Pa.

He is survived by his widow, Mrs. Ethel Williams Howe, and by three children, two sons, Charles and Raymond Howe, and a daughter, Catherine Howe.

The funeral took place at the home of his uncle, Charles Howe, 456 Maple Avenue, Elmira, N. Y., on April 4. The services were conducted by the Rev. Albert G. Cornwell, of the Park Church, of which the deceased was a member. Rev. Cornwell was assisted by Prof. C. F. Binns, of Alfred University. The pall bearers were Samuel M. Kier and Porter S. Kier, of the Kier Fire Brick Company; M. Grover Babcock, of the Pittsburgh Plate Glass Company; and E. Ward Tillotson, Henry A. Kohman, and Stuart M. Phelps, of Mellon Institute. Burial was in Woodlawn Cemetery, Elmira, N. Y.

E. Ward Tillotson

A List of the Journal Contributions of Raymond M. Howe

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"How Slag Temperatures Affect Fire Brick," *Iron Trade Rev.*, **63**, 1288–9(1918); *Iron Age*, **103**, 255–6(1919); *Chem. Met. Eng.*, **20**, 167–8(1919); *Blast Furnace Steel Plant*, **6**, 484–5(1918); *Brick and Clay Record*, **54**, 143–4(1918).

"Tests Now in Vogue for Refractories," *Brick and Clay Record*, **53**, 1063–7(1918).

"Basic Refractories for the Open Hearth," (with J. Spotts McDowell), *Bull. Am. Inst. Min. Eng.*, **146**, 291–309(1919); discussion, *idem*, **149**, 784–6(1919); *Trans. Am. Inst. Min. Met. Eng.*, **62**, 90–112(1919); abstract, *Blast Furnace Steel Plant*, **7**, 227–9(1919).

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"Research in Refractories. Some of the Mistakes Which are Avoided by Full Use of What Science Can Tell," *Sci. Am.*, **121**, 309(1919).

"To What Temperature Must Fire-Brick Burn?" *Brick and Clay Record*, **54**, 975–6(1919).

"Work of the Technical Division of the Refractories Manufacturers' Association," *J. Ind. Eng. Chem.*, **11**, 1145–6(1919).

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"Magnesite Refractories" (with J. Spotts McDowell), *J. Am. Ceram. Soc.*, **3**, 185–246(1920).

"Refractories for Electric Furnaces," *Foundry*, **48**, 911–3(1920); *Iron Trade Rev.*, **67**, 1541–3(1920); *Chem. Met. Eng.*, **23**, 1215–8(1920); abstract, *Blast Furnace Steel Plant*, **9**, 494(1921).

"Use of Fire Clay in Laying Fire-Clay Brick," *Clayworker*, **73**, 136–7(1920); *Gas J.*, **149**, 366–8(1920); *J. Am. Ceram. Soc.*, **3**, 330–1(1920).

"Vital Factors in the Testing of Fire-Clay Refractories and in the Interpretation of Results," *Proc. Am. Soc. Test. Materials*, **20**, 278–90(1920).

"Lime for Refractory Silica Brick," *Rock Products*, **24**, 37(1921).

"A Study of Spalling" (with Robert Fulton Ferguson), *J. Am. Ceram. Soc.*, **4**, 32–46(1921).

"Tests of Fire Brick Made from Ganister, Flint Clay and Plastic Clay Mixtures, with Special Reference to Spalling" (with Mark Sheppard), *J. Am. Ceram. Soc.*, **4**, 206–12(1921).

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"The Influence of Grind and Burn on the Characteristics of Silica Brick" (with William Raymond Kerr), *J. Am. Ceram. Soc.*, **5**, 164–9(1922).

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ACTIVITIES OF THE SOCIETY

THE PRESIDENT'S PAGE

By Robert D. Landrum

The Ceramic Institute—a new idea and one very much worth while. The "virus of coöperative research is still taking."

Twenty-seven years ago a small group of men innoculated the clay-working industry with this "virus" and the result was the organization of our Society. The results of this innoculation were local at first combining for group activity those few whose education fitted them to make use of the results already obtained by scientific workers in the field of the physics and chemistry of the silicates.

Little real research in this field had been accomplished up to this time and each individual worker had a large obligation to perform. The Ceramic Schools were fostered and gradually the number of men with special training and the scientific point of view was increased. The various government bureaus were influenced to recognize the need of research in the ceramic industries and through coöperation with our society provided laboratories and there our members have gone far in their accomplishments in our field.

A long step toward increasing our usefulness was made when the scope of our activities was enlarged to include all the silicate industries. In fact this step has changed the previously accepted definition of the word "ceramic." Next came the movement which gave us our full time executive secretary and his very efficient associates.

And now comes this new idea—The Ceramic Institute. The idea has sprung from several different sources and under as many different names, but in each case it has originated in a trade association. Each time from a group of men associated for commercial purposes. This means much.

Here is our opportunity to again increase our field of usefulness. You members of the American Ceramic Society who are in these associations know that by acting with us they can save duplication. Advise them of this fact. They can employ a "going" organization. An organization with a world-wide prestige of wonderful things accomplished. For twenty-seven years American ceramists have collaborated in the American Ceramic Society through our conventions and publications and established a record of which all may well be proud.

The American Ceramic Society members are loyally determined that their organization shall be and do things productive of the greatest benefit to all who will labor with them. There has been no hesitancy in changing procedure or direction of activities when such was thought to be beneficial and there would be no hesitancy now to so alter our affairs that the Ceramic Institute could be brought into active being.

Our Society is incorporated under the laws of the State of Ohio; it has a Constitution and a form of organization to which there is rigid adherence. These bespeak solidarity and orderliness in purpose. We do not represent the prejudices or special purposes of any person or group of persons.

Our Society is unique in that it is devoted *exclusively* to the promotion of the technical, scientific and artistic advancement of the Ceramic Industries. Questions of trade, tariff and traffic are not within its scope. We are here to promote scientific research, to assist and guide all desiring our assistance or leadership.

Our Society is unique also in that it represents the interests of all ceramic groups and agencies, each and every Silicate Industry, the colleges, the federal bureas, the suppliers of materials and equipment and the Trade Press. Of course, while rights of each group are equal, the benefits are in proportion to their representation and activity. The essential thought I want to bring out is that if the several trade associations will get together in the support of a Ceramic Institute for the purpose of centralizing and planning coöperative research, they would do well to consider using our editorial and

committee organization. Our SOCIETY, a successful, going organization is theirs if they will but use it.

We are growing in strength and in service but feel that as yet we have hardly started. This is a plea, against duplication of effort and expenditure by the trade associations, and for a broader field of service for us.

The SOCIETY was intended to be, and is anxious to be in the largest way a collaboration of all ceramic groups. It requires nothing but the determination of the ceramic trade associations to make the SOCIETY include all that they have in mind that the Ceramic Institute shall be.

I am writing this in Boston where I have spent the day with Dr. Stratton, President of the Mass. Inst. of Technology. Next month perhaps I can tell you how this great University of Science and Technology is planning to coöperate for greater service to the Ceramic Industries.

MEMBERSHIP WORKERS' RECORD

This is the "flux" season in memberships; some have engaged in fields other than ceramics; some have not felt the urge to send in their subscription fee and yet others have changed their status from personal to corporation representative. We mourn the loss of five by death.

May 1 is the time of physical inventory of members and the dropping of the "no response" group; "pruning to the quick," leaving only the vigorous growth. This job is detested but the results in time are pleasing.

This letter from M. E. Manson of Rundle Mfg. Co., is typical of several received recently. They tell in very plain words of a growing industrial appreciation of collaboration in research and education.

"The time has now come when my Company feels that it should have a corporation membership in the AMERICAN CERAMIC SOCIETY. At the same time I wish to keep my personal membership."

Here are the March workers and the fruits of their labor:

	Personal	Corporation		Personal	Corporation
G. Percy Cole	1		C. H. Lawson	1	
M. R. Cuthbertson	1		M. E. Manson		1
Robert F. Ferguson		1	Frank G. Roberts	1	
M. L. Hartman	1		John Sawyer	1	
F. A. Harvey	1		Mary G. Sheerer	1	
S. C. Hemsteger		1	Eric B. Turner	1	
H. A. Huisken	1		Robt. Twells, Jr.	1	
Everett C. Hunting	1		Hewitt Wilson	2	
F. G. Jaeger	1		Office	16	
W. F. Landers, Jr.	1			—	—
R. D. Landrum	3		Total	35	3

	Personal	Corporation	Totals
Net Roster, March 14	1992	299	2291
Acquisitions to April 15	35	3	
	2027	302	
Withdrawals	2	2	
Deaths	5		
Net Roster, April 14	2020	300	2320

NEW MEMBERS RECEIVED FROM MARCH 15 TO APRIL 15

PERSONAL

Allan, John Caldwell, 263 St. James St., Montreal, Canada. Mining Engineer.

Alleman, Fred Franklin, 2940 Harding Ave., Detroit, Mich. Dressler Kiln Operator, Champion Porcelain Co.

Baddeley, Frank, 206 E. California St., Walnut Park, Glendale, Cal. Instructor in Ceramics, Lincoln High School.

Barber, Lyman F., Sales Engineer, Southwestern Engineering Corp., 12th Floor, Hollingsworth Bldg., Los Angeles, Cal.

Bedson, Will, Lawrence Road, R. F. D. 4, Trenton, N. J. General Manager, Elite Pottery Co.

Breneman, John C., Builder and Installer of Furnaces, Bowley Lane and Philadelphia Rd., Baltimore, Md.

Broomall, Grant C., Director of Service Engineering, The American Rolling Mill Co., Middletown, Ohio

Clark, Roland J., Student, N. Y. State School of Ceramics, Box 92, Alfred, N. Y.

Curtis, Edmund de Forest, Wayne, Pa., Proprietor Conestoga Pottery, Instructor Pottery, Penna. Museum and School of Industrial Art, Philadelphia, Pa.

Darby, Geo. M., Research Engineer, The Dorr Co., Westport, Conn.

Dorst, Max, Maschinenfabrik vorm Georg Dorst A.-G. Sonnenberg-Oberlind (Thür), Germany.

Easter, George J., 634 Elmwood Ave., Niagara Falls, N. Y., Assistant Director of Research, The Carborundum Co.

Eigenbrot, Edwin A., 3500 N. 2nd St., St. Louis, Mo. Supt. Enamel Dept., The Bucks Stove and Range Co.

Farnsworth, Richard M., Harvard St., Lancaster, Mass. Miner of Fuller's earth.

Fosseen, A. B., President and General Manager, Washington Brick, Lime and S. P. Co., Spokane, Wash.

Grady, R. F., Jr., 24 W. Frambes Ave., Columbus, Ohio. Student, Ohio State University.

Harcourt, Harry E., 805 Bank of Hamilton, Toronto, Canada. Manager, Industrial Minerals Corp. of Canada, Ltd.

Huot, Constant John, 7353 Denniston Ave., Swissvale, Pa. Glass Chemist, Pittsburgh Lamp Brass & Glass Co.

Kennedy, F. J., 150 Nassau Street, New York City, Gen. Mgr., West Gas Improvement Co. of America, Inc.

Lacy, Roy, 634 S. St. Andrews Pl., Los Angeles, Cal. Assistant General Manager, Pacific Clay Products, Inc.

Leming, Frank, LaOroya, Peru, South America. Cerro de Pasco Copper Corp.

Lowrance, R. E., Beaver Falls Art Tile Co., Beaver Falls, Pa.

Martin, Geoffrey, Rosherville Court, Burch Rd., Graves Eng, Kent, England. Director of Research of Brit. Portland Cement Research Association.

McGrath, Leigh John, Civil Engineer, 1540 S. Walnut St., Casper, Wyoming.

Moran, J. J., 610 Ward St., Vineland, N. J. Assistant Chemist, Kimble Glass Co.

Perham, Alfred C., West Paris, Me., Owner of Quarries.

Pollard, J. A., 503 Union and Planters Bank Bldg., Memphis, Tenn.

Reese, Lemuel V., 813 Cross Ave., Elizabeth, N. J. Chief Engineer, U. S. Metals Refining Co., Carteret, N. J.

Schneider, N. L., District Representative, United Alloy Steel Corp., 614 Swetland Bldg., Cleveland, Ohio.

Sloteman, Ambrose M., 27 S. Fairview St., Lock Haven, Pa. Salesman, Crescent Refractories Co.

Smith, Wm. H., General Manager, Franklin Porcelain Co., Box 83, Norristown, Pa.

Straumford, Joe Franklin, 762 Savier St., Portland, Ore. Asst. Supt., Portland Plant, Denny-Renton Clay & Coal Co.

Sutterlin, Frederick, Supt. Maddock Pottery, Trenton, N. J.

Tobitt, F. A., Sales Dept., The American Rolling Mill Co., Middletown, Ohio.

Van Gelderen, F. M., Enschede, Holsland.

CORPORATION

Garfield Fire Clay Co., Robinson, Ind. Co., Pa. Manufacturers of Refractories, F. E. Robinson, Treas.

Mt. Clemens Pottery Co., Mt. Clemens, Mich. Semi Porcelain Dinnerware, Chas. E. Doll, Treas. & General Manager.

Rundle Mfg. Co., Milwaukee, Wis., Enameled Sanitary Ware, Albert C. Held, Sec.

PERSONAL NOTES OF MEMBERS

Donald B. Atwell has notified the Secretary's office that his present address is 4921 Page Boulevard, St. Louis, Mo.

C. P. Blatchley, until lately of Manor Park House, Worksop-Notts, England, is now living at Parkfield. Mr. Blatchley is manager of the Steetley Lime Co., Ltd.

Oscar Brewer, who has been connected with the Leeds and Northrup Co., of Philadelphia as Sales Engineer, has been placed in charge of the office recently opened by that Company in Cleveland, 1217 Union Trust Bldg.

Emil Bronlund has moved from Alberta, Canada, to Seattle, Wash., 3909 E. Howell Street.

Herman Coors is now living at 5469 Ninth Ave., Los Angeles, Calif.

Arthur De Vol gives as his address 964 Brighton Blvd., Zanesville, Ohio.

Richard D. Ferguson has moved from Lincoln, Nebr., to 1018 Wells St., Apt. 49, Milwaukee, Wis.

Robert F. Ferguson, Secretary of the Refractories Division is located in Bolivar, Pa., Box 74.

R. B. Gilmore of Cleveland recently became affiliated with the Carborundum Co., and is living at 521 Jefferson Ave., Niagara Falls, N. Y.

R. P. Herrold of the Mosaic Tile Co., Zanesville, Ohio, has been appointed representative for the Company's corporation membership in this Society.

Z. C. Kline of the General Electric Co., has been transferred from the Rhode Island Glass Division of that Company at Central Falls, R. I., to the Niles Glass Division, Niles, Ohio.

T. A. Klinefelter is now associated with the Hercules Porcelain Co., Box 124, Belvidere, Illinois.

S. Y. Liu, formerly of Boston, Mass., is now employed as engineer for the Chen Kwong Ceramics Co., Hong Kong, China. His address is % Lai Sang Choung, 297 Queen's Road.

H. S. Magid is located at 103 Perry street, Tiffin, Ohio. He is employed with the Standard Porcelain Mfg. Co., Tiffin Works.

Frank B. Mahoney is employed as superintendent of the Enamelware Division, the Humphryes Manufacturing Co., Mansfield, Ohio. Mr. Mahoney's home was formerly in Chattanooga, Tenn.

Crawford Massey is with the West Coast Plant of the American Encaustic Tiling Co., and his address is 492 E. 46th St., Los Angeles, Calif.

Louis Navias, in the past year a special expert in the Ceramic Division of the U. S. Tariff Commission has joined the Research Staff of the General Electric Co., Schenectady, N. Y., as ceramic chemist.

Carl Perg has moved from Des Plaines, Ill., to 609 W. Kalamazoo Ave., Kalamazoo, Mich.

Robert D. Pike has written that his new address is 582 Market St., San Francisco, Calif.

W. H. Powell has requested that his mailing address be changed from 350 Madison Ave., N. Y., to 41 Plymouth St., Montclair, N. J.

E. E. Pressler has concluded his work with the Bureau of Mines, Ceramic Experiment Station, Columbus, Ohio, and has left for his home in Tosca, Texas.

P. B. Richardson, representative of the Harbison-Walker Refractories Co., has notified the Secretary's office that his correct mailing address is 200 Devonshire St., Boston, Mass.

Wallace C. Riddell, of Berkeley, Calif., has changed his address from 2544 Buena Vista Way to 1960 El Dorado Ave.,

Robert Roadhouse, formerly of Norwalk, Ohio, has moved to Clyde, Ohio.

Drew M. Thorpe, formerly of Pittsburgh, Pa., is at present employed in the Buffalo, N. Y., office of the General Refractories Co.

L. A. Vincent will soon leave Tottenville, S. I., N. Y., and can be addressed at Box 243, New Castle, Pa.

S. Paul Ward has recently moved from McGill, Nevada, to 1200 Oak Grove Ave., Los Angeles, Calif.

Eugenie A. Worman, who has been teaching pottery at the University of Washington, has moved to 4809 Beach Drive, Seattle.

RESOLUTIONS ON THE DEATH OF MR. BUCK

February 14, 1924.

At a meeting held in Atlantic City on February 5, the Enamel Division of the American Ceramic Society took the following action: The Chairman of the meeting, Mr. H. F. Staley, called attention to the sudden death of one of our fellow members, and motion was made of the contribution of a scientific nature made by Mr. Daniel M. Buck.

A committee was named to draw up a resolution. This committee consisted of

Mr. R. D. Wells, Floyd-Wells Company, Royersford, Pennsylvania,

Mr. Emerson P. Poste, Elyria Enameled Products Company, Elyria, Ohio,

Mr. J. A. Aupperle, The American Rolling Mill Company, Middletown, Ohio.

Resolved: That the Enamel Division of the American Ceramic Society desires to record its feeling of deep regret at the untimely death of one of its members and co-workers, Daniel M. Buck, Metallurgist for the American Sheet and Tin Plate Company.

Resolved: That the American Ceramic Society express its appreciation of the scientific contributions made by Mr. Buck and their influence on the study of special problems which engaged his efforts. Therefore be it further

Resolved: That this expression of the appreciation of his wisdom and impartial coöperation in the work on enamel problems be published in the bulletin of the American Ceramic Society; and be it also further

RESOLVED: That a copy of this resolution be sent to Mrs. Daniel M. Buck, 6945 Meade Street, Pittsburgh, Pennsylvania, and to Mr. Eugene W. Pargny, President of the American Sheet and Tin Plate Company, Frick Building, Pittsburgh, Pennsylvania.

NECROLOGY

John Betteley and John Cuffin

Word has been received of the deaths of John Betteley of Ferndale, Mich., on March 28, 1924, and also of John Cuffin of Portland, Ore. Mr. Cuffin died very suddenly July 13, 1923, but word of his death has only now reached the office of the Secretary.

LOCAL SECTION NOTES

Pittsburgh Section.—The officers of the Pittsburgh Section of the American Chemical Society held a joint meeting with the Pittsburgh AMERICAN CERAMIC SOCIETY on April 17 at the Pittsburgh Station, U. S. Bureau of Mines. The motion picture "The Story of Refractories" was presented. "The Manufacture of Refractories" was presented by J. Spotts McDowell. McDonald C. Booze talked on "The Testing of Refractories." An open discussion was held on "The Application of Refractories."

St. Louis Section.—The St. Louis Local Section of the Society held a meeting on April 22. Particulars of this meeting will be given in the next issue of the *Bulletin*.

REPORT ON PATCHING CEMENTS

BY C. W. HILL[1]

Following the St. Louis meeting, a committee was appointed to investigate Patching Cements. Information was received from nearly all the Terra Cotta Companies regarding the cements in use. The field was divided among the members of the committee and a uniform method of testing agreed upon. This also provided for a certain amount of duplication among the workers to give a check on the results of the individual. Test pieces were made.

The actual experimentation was not promptly carried out, the reason being given that the workers were too busy to do the work. Two of the committee later changed their connections, and were unable to do any work.

Some work was done by W. L. Howat and assistants on the commercial cements. The preliminary results indicated that cements of the basic phosphate type are better suited than some of the commercial cements on the market. Further investigation would include a study of the best compositions of this type of cement and correlation of these results with those on the dental cements with which it is allied. It has been impossible for over a year to revive this work.

The committee has but little to add to the common knowledge of this subject. It was clearly indicated by the original replies that at that time none of the companies had investigated the subject thoroughly. The tests reported thus far indicate a wide variation in the value of various cements in use, some of those being of poor quality.

On account of the incompleteness of the results, and the consequent danger of incorrect conclusions, this report is made without experimental data.

[1] Chairman of Committee.

It is clearly a field which should be investigated. Our experience would indicate the extreme difficulty if not impossibility of investigating the subject properly and in a reasonable time by means of individual ceramists working in coöperation. Apparently few of the companies have a large enough staff of ceramists to be able to assign a man to work on the problem intensively.

While the problem could be cleared up by one man in a fairly short time, it is one in which all companies are interested. The suggestion has, therefore, been made to the National Terra Cotta Society that they consider referring the problem to the Bureau of Standards to be handled at the same time with other investigations now under way.

MANY INVITATIONS RECEIVED

Western Manufacturers Eager to Entertain

The following firms of the western coast have extended to those members of the SOCIETY who will attend the Pacific Coast Meeting the cordiality of their welcome. Members of the East and Mid-west are assured of the finest trip both in scenic value and of interest to technical ceramists that the SOCIETY has ever sponsored. The dates are July 21 to August 20.

Henry Weiss, West Coast Porcelain Mfrs., Millbrae, Calif.
H. C. Elliott, Pres. Cascade China Company, Portland, Oregon.
H. R. Kreitzer, Secy., Columbia Brick Works, Portland, Oregon.
J. B. Watson, Mgr., Idaho Fire Brick Company, Troy, Idaho.
Carl F. Kneisel, Secy., Sheridan Press Brick & Tile Co., Sheridan, Wyoming.
R. M. Bard, Asst. Mgr., American Fire Brick Co., Spokane, Wash.
Paul S. MacMichael, Pres. Northern Clay Company, Auburn, Wash.
L. R. Burdick, James Graham Mfg. Company, Newark, California.
A. J. Gladding, Gladding, McBean & Company, San Francisco, Cal.
John T. Roberts, Mgr., Stockton Fire Brick Co., San Francisco, Cal.
F. A. Costello, Pres., California Pottery Co., San Francisco, Cal.
N. W. Stern, Pacific Sanitary Mfg. Co., San Francisco, Cal.
R. B. Keeler, California Clay Products Co., South Gate, Cal.
Findlay M. Drummond, Alberhill Coal & Clay Co., Los Angeles, Cal.
H. B. Potter, Secy., Los Angeles Pressed Brick Co., Los Angeles, Calif.
H. S. Thatcher, Gen. Mgr., Celite Products Co., Los Angeles, Calif.
R. B. Ahlswede, Secy., California Metal Enameling Co., Los Angeles, Calif.
F. B. Ortman, Vice-Pres., Tropico Potteries, Inc., Glendale, Calif.
Earnest H. Batchelder, Batchelder-Wilson Co., Los Angeles, Calif.
Fred H. Robertson, Claycraft Potteries, Los Angeles, Calif.
C. D. Gram, Vice-President, Vitrefrax Company, Los Angeles, Calif.
W. G. Brady, Secy., Pacific Clay Products, Inc., Los Angeles, Cal.

George P. Fackt, Northwestern Terra Cotta Co., Denver Division, has extended in the name of the Colorado members a welcome to Denver and Colorado Springs, to their ceramic plants and their social facilities.

A great trip from Chicago to Spokane, Seattle, Portland, San Francisco, Lincoln Los Angeles, Denver, Colorado Springs, and return. A personally conducted tour, hotels and all conveniences arranged, a splendid mixture of sight seeing, social intercourse, plant visit and technical meetings that will not for a long while be surpassed. Our Western members guarantee these and the facilities are provided.

NOTES AND NEWS

BUREAU OF STANDARDS

Opportunity for Ceramists

The National Bureau of Standards, which is continually being called upon more and more to investigate problems in the interests of American industrial development, is at this time offering unusual inducements to young men who wish to avail themselves of the opportunity of training in investigational work. This is particularly true of the Ceramic Division. This Division has for many years supplied the industry, in a large measure, with technically trained men, and the demand made upon it has been so great as to exceed the supply. There are at this time several openings, offering exceptional opportunities for men interested in all ceramic lines, more especially whiteware, both for graduates and for men who have had one or more year's experience in the field. Applications should be filed through the Director, Bureau of Standards, Washington, D. C.

Increasing the Strength of Lime Blocks

Previous work by the Bureau indicated that when cast lime blocks have the same distribution of core space as gypsum blocks they will have about the same weight but less strength. It has been found that by changing the design of a block so that the total volume of core space is the same but is contained in two elliptic cores instead of four circular cores the strength of the block can be increased sufficiently to meet the requirements now put upon gypsum blocks. This work has been conducted in coöperation with the National Lime Association and a final report on the matter has been transmitted to that organization.

Recommended Specifications for Ceramic Whiting

Circular No. 152 of the Bureau of Standards, obtainable from the Superintendent of Documents, at 5 cents a copy consists of the fifth of a series of specifications for the kinds of lime required by different chemical industries. The preceding four dealt, respectively, with lime used in cooking rags, in causticizing, and in the manufacture of sulphite pulp and glass. This deals with lime used in making glazes, enamels, and similar ceramic products. Ceramic whiting is really calcium carbonate, with or without a small amount of magnesium carbonate, but it performs the function of lime. It should contain not less than 97 per cent of carbonates, and should be very fine, so that 98 percent of it will pass a No. 200 screen.

Recommended Specifications for Quicklime and Hydrated Lime for the Manufacture of Sand-Lime Brick

Circular No. 150 of the Bureau of Standards, copies of which may be obtained from the Superintendent of Documents at 5 cents a piece, covers the sixth of a series of specifications for the lime used in various chemical industries. To assist in the development of these specifications, the Bureau has called together an Interdepartmental Conference on Chemical Lime, composed of representatives of the Geological Survey and Bureau of Mines of the Interior Department; the Bureau of Soils, Bureau of Chemistry, Forest Service, and Fixed Nitrogen Research Laboratory of the Department of Agriculture; and the Chemical Warfare Service of the War Department. The present specification, based on a draft originally prepared by W. E. E mley, of the lime section, Bureau of Standards, has been unanimously approved by the above conference and by the National Lime Association.

Either quicklime or hydrated lime may be purchased for making sand-lime brick, but the former must be completely hydrated before it can be used. Material of about 85 percent purity and reasonably low in magnesia is required. The lime must also be reasonably fresh, as indicated by a low content of carbon dioxide. Methods of analysis are given in detail.

Recommended Specification for Quicklime and Hydrated Lime for the Manufacture of Silica Brick

Bureau of Standards Circular No. 153 covers recommended specifications for quicklime and hydrated lime for the manufacture of silica brick. A brief description of the way in which lime is used for this purpose is followed by a general statement as to the quality of lime required.

The standard of quality is set at 92 percent, based on the non-volatile matter, with maximum limits of 5 and 10 percent carbon dioxide, depending upon whether the sample is taken at point of shipment or of destination.

Complete directions for sampling and testing are included. Copies may be obtained at 5 cents a piece from the Superintendent of Documents.

Equalizer Apparatus for Transverse Tests of Bricks

In Technical News Bulletin No. 79, Item 20, brief mention was made of the apparatus designed by H. L. Whittemore for the transverse testing of bricks.

A description of this apparatus is now available in printed form as Technologic Paper No. 251 of the Bureau of Standards, copies of which may be obtained from the Superintendent of Documents at 10 cents a piece.

The new equalizer apparatus consists of two equal arm levers about the length of the brick, mounted side by side on a pin at the middle of their length. At each end the levers have barrel-shaped knife edges carried on vertical spring-steel plates, which allow longitudinal movement of the knife edges. The levers equalize the four forces acting upward on the lower surface of the brick. The upper knife edge and the bearing plate are self adjusting.

Refractories for Boiler Settings

At a recent conference of the committee on refractories of the Federal Specifications Board the tentative specifications for boiler setting refractories were revised to meet the suggestions submitted by the industry and by the various Government departments since their promulgation as "tentative." The specifications as revised will be submitted to the Federal Specifications Board. At the conference it was further decided to take up the preparation of specifications for fire clay used as a mortar and for the so-called "plastic" refractories used in building rammed-up boiler linings.

Experiments with Glass House Refractories

As mentioned in Item 4 of Bulletin No. 83 the Bureau has been carrying out some experiments on the composition and method of making the "cut offs" used in controlling the flow of glass to automatic bottle machines. During the month one complete set of these "cut offs" consisting of 25 shapes has been cast. For this work a mixture of clay and grog that has been found to be resistant to glass attack and spalling was used. Four additional shapes of a second set, the body composition of which is somewhat different as to grog sizing as well as grog-feldspar content, have also been cast. The ten shapes reported as cast during the last month have been burned. A plaster mold has been completed for casting "flow spouts" which are used in connection with the cut offs," the proper specific gravity for the slip in this process has been determined, and six of these shapes have been cast. The same bodies used in the manufacture of the "cut offs" are being used in making up the "flow spouts."

The Abrasive Hardness of Ceramic Glazes

The glazes on six brands of vitreous ware and two glazes prepared at the Bureau were tested for abrasive hardness during the past month. The two Bureau glazes, although of typical composition, showed much greater abrasive hardness than any of the glazes on commercial ware and somewhat greater hardness than porcelain glazes. The hard glazes were found to be comparatively thin and yet they were as satisfactory in appearance as the thicker ones. It therefore appears that thick-

ness may have an important bearing on the hardness of ordinary commercial glazes and this phase of the problem will be given further study.

The Thermal Dilation of Ceramic Materials

Scientific Paper No. 485, which may be obtained from the Superintendent of Documents at 5 cents a copy, describes an interference method and apparatus for measuring the thermal expansion of ceramic materials. The samples, in the form of small pins, 0.5 to 10.0 mm. in length, are placed between two fused quartz interferometer plates and heated in an electric furnace. The elongation of the samples is determined from the number of interference fringes that pass reference marks on the interferometer plate while the sample is being heated. A change in length of the sample of one-millionth of an inch can be easily detected. In order to show the application of this method to the study of the expansion of ceramic materials, measurements were made on several samples of glaze, terra cotta, tile, porcelain, and clay in the temperature interval 20° to 1000°C. Some of the samples were especially prepared, while others were taken from finished products, some of which had failed in service.

BUREAU OF MINES NOTES

Research Fellowships Offered

Starting with the school year, October 1, 1923, three fellowships were initiated at Ohio State University as a result of a coöperation between the U. S. Bureau of Mines and The Engineering Experiment Station of Ohio State University. The fellowships, which carry a stipend of $750, are for the purpose of securing data in the ceramic field. The investigations are carried on in the laboratories of the Bureau of Mines and are jointly directed by the staff of the Bureau and the head of the college department in whose field the particular research falls. During the past year the following problems were investigated:

1. The cause of volume changes in fire brick during heat treatment.
2. Dolomite investigation No. 3 (binders and method of fabrications).
3. Utilization of pebbly clays for heavy clay products manufacture.

These fellowships for the coming school year will be filled about May fifteenth. More detailed information can be obtained in regard to the character of the work or in regard to the qualifications required of an applicant, by addressing an inquiry to either: Dean E. A. Hitchcock, Director, Engineering Experiment Station, Ohio State University, or G. A. Bole, Superintendent, U. S. Bureau of Mines Experiment Station.

Higher Salaries for Ceramic Engineers

The United States Civil Service has recently advertised an examination open to ceramic engineers for government service, the salary ranging from $3800 to $5000. These salaries are considerably higher than any hitherto offered for a similar opening in government service, and hence should attract experienced engineers in the ceramic industry.

COLLOID SYMPOSIUM AT NORTHWESTERN UNIVERSITY

Ceramic Papers Scheduled

Members of the American Ceramic Society will be interested in the announcement of the program of the Colloid Symposium to be held at Northwestern University, June 19, 20, and 21. Among the speakers appearing on the program are the following, whose subjects will be of interest to ceramists.

A. V. Bleininger, "Properties of Clays."

Eugene Bingham, "Fluidity and Plasticity in Colloid Control."

Jerome Alexander, "Bentonite and Other Colloidal Clays."

W. J. Kelly, "The Determination of Size of Particles and Their Control."

F. P. Hall, "The Effect of Hydrogen-Ion Concentration on Clay Particles."

There are other important papers on the program, but the above are of especial concern to ceramists.

NATIONAL LIME ASSOCIATION MEETING

The National Lime Association will meet on May 20, 21, 22, 23 at the Greenbrier Hotel, White Sulphur Springs, West Virginia. The program will include not only a report of the activities of the Association, but there will also be scheduled certain special features, such as a Golf Tournament.

COMMON BRICK MANUFACTURERS ASSOCIATION CONSIDERS PROPOSAL OF A CERAMIC INSTITUTE[1]

The cement industry has a concrete Institute, which functions to disseminate authoritative data on concrete, and whose findings are given greater prestige than if issued by the Portland Cement Association and are listened to with greater respects by architects, engineers, Government departments, and the public.

A Clay Products Institute can be organized to speak in the same way for this industry, face brick, hollow tile, drain tile, flue linings and sewer pipe, refractories and pottery, at no greater cost at the start than that required for a desk, letter heads, and the salary of a director.

The Concrete Institute appears to be in close touch with Lewis Institute, a concrete testing laboratory run under the able direction of Prof. Abrams.

We do not propose to build a laboratory. Instead, the director would correlate the work of the research departments of the Universities, the Government Departments and other testing agencies supported already by the taxes every brick man pays.

The present Ceramic Society has offered to act as the nucleus of the proposed Institute, and it might be easier to get such an Institute started and sold to the other industries by making use of the present organization and facilities of the Ceramic Society.

Any tests desired would be asked for by the Clay Products Institute. The representatives of the various industries within the Institute would, of course, supervise all tests as at present, but the results would be published with the prestige of the Clay Products Institute behind them.

Not only technical data, but non-technical information of interest to the average man might be issued by the Institute also.

The entire cost for the first year should not exceed $7,500 to $10,000; and this overhead should be borne by the Associations supporting the Institute. The cost of any testing work would be paid for by the Association or the member who ordered such work done—exactly as is the case at present.

The second proposal, entirely distinct from the first, is this:

Mr. Stoddard and Mr. Bowen, in going around the country, have found that there is a distinct need for some testing laboratory, where clays can be tested. If a manu-

[1] From report of Proceedings of Sixth Annual Convention.

facturer is not entirely satisfied with the product he is getting from his clay, he wants to know why; or, if his clay bank is exhausted and he wants to continue in business in the same locality, naturally he wants to locate some other source of supply of his material.

It seems that there is quite a strong demand for a laboratory of this kind, and I am very pleased to offer to you this suggestion for the running of a laboratory now established.

Proposal for the Running of an Experimental Brick Plant

There is a practical stiff mud brick plant now lying idle in one of the buildings at Ohio State University at Columbus, designed by Col. Orton.

It is proposed that the U. S. Bureau of Mines, Ohio State University and this Association coöperate and run this plant to test clay in a practical manner.

Plant Cost: The plant cost originally about $11,250. It never has been run. It would need a little changing and additional equipment to put into actual operation. The University would pay part of such additional cost and we would pay part. Our part is estimated by Mr. Bole, Supt. of the Ceramic Station of the Bureau, at $2250.

Operating Cost: Cost of operation would be borne partly by us and partly by Bureau of Mines. Based on full time operation of plant (about 12 to 14 kilns per year) this would be about as follows. (Bureau of Mines estimate.)

	Our expenses	Bureau and University expenses
Fuel	$1000.00	
Repairs and Upkeep	1000.00	
Cartage of clay	1200.00	
Power, light and heat		$ 650.00
Superintendent, at $3500	1000.00	2500.00
Junior engineer		1800.00
Labor	1500.00	
	$5700.00	$4950.00

In addition, all overhead is borne by U. S. Bureau of Mines.

Ceramic Experts Available: The entire facilities of the Bureau of Mines Experiment Station and the Ceramic Department of Ohio State University would be available for consultation without charge. Personnel includes ceramic engineer, chemists and petrographer. Bureau has complete ceramic laboratories fully equipped.

Mr. Simons: I want to lay this before the members and directors for consideration. It is in reference to raising funds to continue the activity of your national association, and take up just such things as have just been presented, and I would like you to take it into consideration. I don't ask for any action at this convention, but I would like to have you think about it.

We find that we are getting great returns in this state and expect, from the amount of money we are putting into it, and hope, that we will have demonstrated in the course of a year or so, that we can even grow double the amount.

The law of compensation is that you only get out what you put in. You have to give in order to get, so under that policy, we are satisfied here, and I wish the members of this organization would consider it possibly at another meeting, or the board of directors would take it under consideration, and ask for a referendum on it, to the members, so that we might get action.

I don't believe that the Association should go into any proposition where we sustain a laboratory at this time, because we are short of funds. If men want to have their clays examined or anything of that kind they should be willing to pay for it.

There are too many men going into the brick business who are not qualified to be in. They should learn something first. A good way is to get up early and go out to the plant and work hard. Don't believe a lot of things a lot of promoters who come along try to tell you what clay will do. It isn't so hard, if you are a little bit patient and go down to the foundation of the business and work along with it, to find out for yourselves.

Mr. F. T. Houlahan: (Seattle, Wash.) If I may I would like to differ with my good friend, Mr. Simons. I think I have a good reason to differ with him. Not so very long ago our association mailed out to the different members and the other trade associations did the same thing, a report of a committee of some sort or other, that went into the burning problem. We got this report because of our membership in the association.

We have reduced our burning time and saved money in burning, and I would like to make a motion at this time that this association go on record as favoring coöperation with the Bureau of Mines.

Mr. Schlake: I am not going to oppose that motion, although I am not satisfied in my mind that we are right to go along with it or as favoring something that might require the expenditure of a considerable sum of money. I believe that any undertaking along those lines is going to pay when the proper time comes. I would suggest that instead of taking action here, where it is going to be impossible to weigh all the arguments pro and con, that the matter be referred to the Board of Directors. I have no objection to coupling this up as an amendment to the motion that the convention feels that this subject is well worthy of consideration, and hope for favorable action.

Mr. Houlahan: Under those circumstances I will withdraw my motion. I think probably it is better that the board should act on it, but I feel very deeply on this subject. We have a Bureau at the University of Washington and it has done all the clay workers around that section a lot of good where we have taken advantage of it, and I think wherever the clay worker can work in harmony with the technical man he should do so. Understand, I am not a technical man, and up until a year or two ago I thought a technical man was the "bunk"—but there is merit in them; some of them at least, and they have good horse sense. They are doing mighty fine work and I am for that right down the line.

Mr. Stephenson: Last year a communication came to my plant. One of my boys is in charge of it, and he hadn't very much experience in burning brick and did not have that to do—he was in general charge of the plant, that was all. This came from the Common Brick Association, and was a partial report from the Bureau of Standards on burning. The boy read that over and he immediately saw that someone had been thinking; someone besides a theoretical man, someone who had gone to the bottom of it. He read it over again and then he took it out to his head burner. He said, "I wish you would read that over, at your leisure, and when you get through, read it over again, and let me know what you think about it."

The burner came back a little later and said, "It won't do. There is nothing to it It is too dangerous to fool with." He said, "I have burned brick in just about that same length of time, but five days, or five and a half days—you can't do it, and make a regular practice of it." When asked why, he said, "A man couldn't stand it, he'd have to be right on the job every minute of the time. I wouldn't have anything to do with it."

"All right," said my boy, "I am going to take that and burn a kiln myself according to that paper."

He took charge of it and burned the kiln off in about five days and four hours. We had been burning an average of eight and a half to nine days, and since that time we have adopted the plan entirely. We followed out the suggestions to the letter, and we

have cut our burning time down to anywhere between five and five and a half days. Before we tried that we didn't have kiln room enough, and now we have kilns standing idle. We have reduced the amount of fuel and labor also, and I would say that we are saving enough on this one investigation of the Bureau of Mines through the coöperation of the Common Brick Manufacturers Association for me to contribute a fellowship to the Bureau of Mines individually, but I feel like Andrew Gump. He lost all his money in the hairbrush and mirror business and as soon as it came back to him he told them immediately, "I knew I could arrange some way to get it back."

I am not wanting to give what I have already gained by this information, I am wanting more information. I am willing to start over again and contribute with the association.

CERAMIC STUDENTS WIN FIRST PRIZE IN THE UNIVERSITY OF WASHINGTON ENGINEERS' OPEN HOUSE

The ceramic engineering students, College of Mines, University of Washington (Seattle) competed with the departments of Civil Engineering, Mechanical, Chemical, Forestry, Fishery and Electrical Engineering and walked off with the first prize. Exhibitions were made of the manufacture of brick and tile; pottery by the hand throwing, casting and jiggering methods; glass tumblers; spraying and firing of terra cotta; purification and filter pressing of Eastern Washington kaolins; manufacture and testing of super-refractories and enameled metals. Over 200 two-inch brown and white jugs made by the students together with 50 colored vases were given out as souvenirs. The Engineers' Open House is given every two years at the University of Washington and has quite a reputation for high class exhibitions. Several thousand people visited the department on Friday and Saturday, April 11th and 12th.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21–Aug. 1924	Trip to Pacific Coast
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Foundrymen's Assn.	Oct., 1924	
Am. Gas Assn. Inc.	Oct., 1924	
Am. Iron and Steel Institute	May 23, 1924	New York
British Assn. for the Advancement of Science	Aug. 6–13, 1924	Toronto, Canada
Chamber of Commerce of the U. S. A.	May 6–8, 1924	Cleveland, Ohio
Chemical Equipment Assn.	Sept., 1924	
Colloid Symposium	June 19–21, 1924	Northwestern University, Evanston, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec. 9, 1924	New York (?)
Manufacturing Chemist's Assn.	June, 1924	New York
Natl. Assn. of Mfrs. of U. S. A.	May 19–21, 1924	New York
Natl. Assn. of Stove Mfrs.	May 14–15, 1924	New York, Hotel Astor
Natl. Bottle Mfrs. Assn.	Last Wk. Apr., 1924	Atlantic City

Organization	Date	Place
Natl. Glass Distributor's Assn.	Dec., 1924	Pittsburgh
Natl. Lime Assn.	May 20–23, 1924	White Sulphur Springs, W. Va.
Natl. Ornamental Glass Mfrs. Assn. of U. S. and Canada	June 24–26, 1924	New York
Natl. Paving Brick Mfrs. Assn.	Dec., 1924	
Society of Promotion Engineering Education	July, 1924	Boulder, Colo.
Stoker Mfrs. Assn.	May or June, 1924	
U. S. Potters Assn.	Dec., 1924	Washington, D. C. (?)
Western Glass and Pottery Assn.	June 15, 1924	Pittsburgh
Western Society of Engineers	June 4, 1924	Chicago

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

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EDITORIAL

SCIENTIFIC RESEARCH AS AN ASSOCIATION ACTIVITY[1]

By H. E. Howe[2]

How slow industry has been to avail itself of the benefits of science and to give it a real opportunity to demonstrate its potentialities!

Many men have been signally successful because of their alliance with science. Others have stood by marveling but blind to the example set before them.

Pasteur, whose remarkable discoveries saved France a sum estimated as far greater than the indemnity paid to Germany at the close of the Franco-Prussian war, said, "In our century science is the soul of the prosperity of nations and the living source of all progress. Undoubtedly the tiring daily discussions of politics seem to be our guide—empty appearances. What really leads us forward are a few scientific discoveries and their applications."

Ten or twelve years ago Robert Kennedy Duncan pointed out that "during the next five years the small manufacturer who is swept out of existence will often wonder why. He will ascribe it to the economy of large scale operations or business intrigues or what not, never knowing that his disaster was due to the application of pure science that the trust

[1] Presented at the Atlantic City Meeting, Feb., 1924 (General Session).

[2] Editor, *Industrial and Engineering Chemistry*, Washington, D. C.

organizations and large manufacturers are already beginning to appreciate."

It is true that many of our great discoveries have appeared to be by chance, but it can be demonstrated that these were made by trained observers systematically searching for new facts. Inventions are rarely made to order. To quote Dr. W. H. Bragg, a noted British scientist:

"It is easy and fascinating to suppose that a new invention is found as complete and clean as a nugget of gold, as unexpected and as unconnected with its surroundings, and finally as readily convertible into cash.

"The truth is very different. Science does not increase by the constant addition of new facts to old as a literary collection increases by the addition of new books or a museum by the addition of new specimens and curios. Science grows like a tree, which shoots out new branches continually and at the same time strengthens the old, always growing higher into the light. Like the tree, science needs wise cultivation. The nourishment of the tree, its training and pruning have their true counterparts in science. In both the fruits come as the reward of skill and labor."

To gain the greatest benefit from applied science, individual manufacturers should establish their own research and control laboratories. These laboratories should be well equipped and manned, made attractive places to work, be adequately supported and genuinely considered an intimate, integral, internal part of the organization. A laboratory can become more important than the sales or the advertising department. The Hadfield Steel Works in England have actually become attached to the research and control laboratory rather than the laboratory attached to the works.

Every industry finds it necessary to engage upon fundamental work, work in the field of pure science, upon which the so-called practical work or technology depends. Occasionally, indeed often, industrial laboratories undertake this work on their own account, but the work involved is so extensive that the individual corporation is seldom justified in doing it as thoroughly as is required.

The results of fundamental science research should not be left unpublished, since their disclosure can repay only in part the debt which any organization owes to science. Fundamental data do not of themselves alter the relative positions of competitors. It is the ability to apply the information that makes the difference between the success of these rivals.

An appreciation of these facts has led to associations engaging upon programs of scientific research. The great advantage gained early in the war by Germany, due largely to thorough organization among her scientific men and the confidence which her manufacturers have always had in science, impressed itself upon Great Britain. She saw the necessity of meeting such organization with an organization of her own scientists and set up an Advisory Council of Scientific and Industrial Research. This

council later became a department of the government, and known as the Department of Scientific and Industrial Research. This has been followed with some slight changes by the various English possessions. In Great Britain a million pounds was set aside by the government to encourage associations to put money into the work of organization, laboratory equipment, and staff. Pound for pound has been the plan for such organization and more than twenty-five associations have been formed, licensed, or are in process of formation. A further grant of a million pounds has been recommended by the government for another five-year period.

In America it has seemed best for associations to conduct their scientific activities without the aid of government money, for with the use of public funds there always goes a certain amount of necessary control which becomes irksome. Our trade associations have been formed without regard to scientific work and have undertaken this work only after a long period of education, during which it has been demonstrated that even competitors can work harmoniously on a scientific program.

A large number of the American associations began their work with standardization. The United States Bureau of Standards has prepared a report on the standardization of work going forward in 102 trade associations. Such work has been of real value.

We shall here recite the experience and methods of a few of the American associations.

California Fruit Growers' Exchange

The California Fruit Growers' Exchange, a coöperative, non-profit, non-capital stock corporation composed of 12,500 growers, organized a research laboratory primarily to develop methods for the conversion of the lower grades of citrus fruits into stable, salable products. The laboratory is operated at an approximate cost of $12,500 per year. Funds are obtained by an assessment of so many cents per box of fruit marketed. As a result of the work accomplished in coöperation with government agencies, the research laboratory has won an established place in the citrus industry.

The Magnesia Association of America

In contrast with the California Fruit Growers' Exchange, the Magnesia Association of America consists of only four manufacturers of magnesia products. Its purpose is the determination of constants and engineering data relative to the use of 85% magnesia as an insulating material, and the education of engineers, architects and plant owners to the importance of using insulating material in accordance with scientific data. The income of the Association is secured by a flat percentage tax laid on the actual goods shipped. The Association is operated on a budget system. Its

income has varied, depending upon the extent of activities, from a minimum of $20,000 annually to $125,000. This Association finds it advantageous to conduct its scientific work through a fellowship established at the Mellon Institute of Industrial Research. The findings of this research are given wide publicity, generally through the engineering and technical papers but to some extent through popular magazines and directly by mail.

National Canners' Association

Among the most successful has been the National Canners' Association. The fees for membership are one per cent per case of canned goods manufactured, and in addition to the support of the secretary's office and general machinery of the Association, including commodity advertising, the income is devoted to certain lines of informational work and scientific research. As conclusions are reached, valuable publications are issued. The laboratory carries on coöperative work in several important directions.

In some cases arrangements are made for the work itself to be done in laboratories outside the Association, but in coöperation with it. In matters of education, trade promotion, improved forms of reports, standards and research, the laboratories of the Association and the Association itself coöperate fully with both state and federal governments. Appropriations for single items of research have become as large as were the original allotments for the entire research program (about $30,000).

Clay Products Association

The Clay Products Association has undertaken research upon the study of the manufacture of salt glazed vitrified clay pipe. Results have not yet been reached, but it is gratifying to find that those interested in one of the world's oldest industries—ceramics—have found that it will be well to supplement many, many years of experience with scientific data.

In addition to research at Mellon Institute the Clay Prdoucts Association maintains a physical and chemical laboratory in Chicago where many problems directly affecting the use of their materials are studied. The Association is also engaged in the preparation of a handbook for the use of engineers, architects, and others, and feels that its scientific program is well worth while. The income of the Association is based on the amount of goods sold and the budget includes items for the scientific work decided upon for the year in question.

American Malleable Castings Association

The American Malleable Castings Association realized that the considerable number of inferior castings being made by the trade interfered decidedly with development of the market for malleable castings. The

Association formed a research committee, equipped a laboratory, secured a competent director, and began the work of so improving the products of every member of the Association that malleable castings would sustain a reputation for high, dependable, and uniform quality. The work has been going on for the last ten years, which is a testimonial to the high regard which the members of the Association have for research.

I believe the members who formerly made the best castings continue to do so, but the industry as a whole is far better off and the work of the Association in this direction has attracted attention in most of the countries abroad.

The Association spends about $150,000 per year in research. Work on control, in addition to research, is conducted at the expense of individual members for their benefit.

The various plants are visited each month to inspect castings and when quality is found to be deteriorating specialists go at once to see the trouble and endeavor to solve the problem.

Inspectors also see to it that the castings shipped by the producer are equivalent in quality to the test bars submitted to the laboratory.

A research committee meets the second Tuesday of every month in Chicago, followed by a regular meeting of the western members of the Association. The third Friday of each month finds the eastern members meeting in New York City. Joint meetings of eastern and western members are held quarterly in Cleveland.

American Gas Association

In the American Gas Association most of the income is derived from membership dues, of which there are two classes—company members and individuals. In addition, a charge is made for certain special service rendered to members and there is some revenue from the sale of publications.

The Association is rendering a very definite service to its member companies. It has upon its staff two members available for either field or installation work. Operating problems, industrial fuel development heating standards, the examination of gas appliances and gas consuming devices as regards fire hazards, efficiency, etc., indicate some of the lines of endeavor.

The Asphalt Association

The Asphalt Association is one of the newer industrial groups, having been formed in May, 1919. The members are assessed $100 annually as dues, but no additional payment is made by them. Contributing members pay a lump sum yearly, fixed by the Board of Directors in general conformity with the extent of business done by them and benefits to be derived.

This is generally an assessment varying from 32 to 40 cents per ton of paving asphalt sold. The Association was formed to increase the market for asphalt in paving, and in order to carry on its educational program and do constructive work, it calls upon science. This has to do not only with asphalt itself, but with the chemical and physical factors involved in its application, coöperation in designs for highway construction and the behavior of asphaltic types of pavement under various conditions of service.

Paint Manufacturers Association

The Paint Manufacturers Association of the United States and the National Varnish Manufacturers Association support an educational bureau. The educational bureau is supported by five-year subscriptions which range from $50 to $10,000 annually. These are voluntary upon the part of members of both associations and any others interested in the work. The funds for the bureau are kept distinct from the treasuries of the two associations.

The educational bureau has carried on research and experimental work for a number of years and published the results widely. It has studied special applications of paint and varnish and has developed new compounds, as for example, a special paint designed to reduce the fire hazard of wood shingles. When a new formula is devised and developed to the manufacturing stage, it is the custom of the associations to grant licenses for its manufacture to members of the associations.

Silk Association of America

The Silk Association of America has directed much of its attention to the conditioning and testing of raw silk. It has made important contributions to the subject and has performed a service in coöperating with foreign producers. This has led to silk being brought to our market in the condition best suited to our uses. Tests acceptable to both buyer and seller have been devised and there are many phases of silk production which have engaged the attention of the Association. These include testing of dyes, researches upon the fastness of colors to sunlight, fundamental work upon the physical constants of the individual silk fibers, etc. The conditioning house makes a charge for the work done and is owned by the Association. The work done is more satisfactory than was previously possible in a similar establishment privately owned.

National Association of Cotton Manufacturers

The National Association of Cotton Manufacturers has given extensive consideration to research in the cotton industry. Beginning with a research committee, upon which were cotton mill men and scientists, a larger

program has now been worked out. A research secretary has been employed who in addition to a certain amount of service work will travel in order to learn at first hand those problems confronting the various members of the Association which may be solved through applied science.

American Institute of Baking

The American Institute of Baking is one of the major activities of the American Bakers Association. The Institute is the outgrowth of an idea backed by one or two individuals who learned from personal experience what applied science can do for them. From a modest beginning the Institute has now advanced to the place where it owns a building, is giving short instructional courses, performs a plant problem service, and conducts research on problems fundamental to baking. A bulletin on the technology of the business is issued. Support has come to the project in such volume that a broad program has been made possible and is being put into effect.

This experience of the bakers is made even more interesting by the fact that by far the majority of commercial bakers would consider themselves unable individually to afford a laboratory or take on any expense which might not lead to immediate returns. Through the coöperative effort in which they are now engaged, the trade as a whole is able to avail itself of new principles and methods which otherwise would have been impossible.

American Society of Heating and Ventilating Engineers

The American Society of Heating and Ventilating Engineers devotes about $25,000 a year to its research laboratory. The funds are raised by popular subscription and the work is done in coöperation with the U. S. Bureau of Mines, Pittsburgh laboratory. More than twenty definite research projects have so far been undertaken. No tests, experiments or research are conducted for compensation.

Association of Manufacturers of Chilled Car Wheels

The Association of Manufacturers of Chilled Car Wheels has for its purpose the advancement of knowledge concerning the manufacture and service of car and locomotive wheels by discussion, investigations, and reports of experience of experts and of members of the Association. Information is gathered and distributed on the manufacture and service of car and locomotive wheels. When the organization was formed, every car had a special design of wheel. The Association has succeeded in standardizing to four types designed for cars of different capacities. These four take the place of about 175 patterns.

A consulting engineer is retained on full time and a physical laboratory

has recently been installed to further the work of the Association. There are 25 members of the Association.

Funds are obtained by assessment, based upon the capacities of the plants. Assessments in amounts of $5,000 are levied when funds are required. The total expense of operating the Association in a typical year was estimated at $40,000.

Portland Cement Association

The Portland Cement Association represents more than 90 per cent of the total production of Portland cement in the United States. In 1905, they began to discuss a research laboratory for the Association but a definite plan of action was not decided upon then and funds were not available. From 1916 on, the present activities of the Association were developed, having to do principally with scientific educational and promotional work. District offices are maintained to give service to users of cement, and through the structural materials laboratory research has been carried on and has proved its value to manufacturer and user alike.

A corps of engineers, chemists and assistants give their entire time to the work and the results are published in the form of papers presented by them before scientific societies and in bulletins issued by the laboratory for general distribution. The annual budget runs into several hundred thousand dollars, which includes the cost of maintaining the service engineers in the various district offices.

The research has to do largely with devising means for using local materials, and fundamental study on the part played by various components to concrete and cement, and the influence upon strength of such factors as temperature and moisture during setting, excess water in mixing, and similar factors. Assistance has been rendered in designing standard structures and in devising uniform rational construction practice.

National Lime Association

In its effort to give the public better information on lime to the end that it may be used more accurately and to follow up its educational work properly, the National Lime Association has found that in even so old a material as lime there is much need for investigation and research. This touches upon the properties of the materials produced in the different quarries and with different equipment. Much time is spent on the peculiar application of lime in more than 165 industries.

The investigational work of the Association is conducted not so much in its own laboratories as in coöperation and collaboration with other institutions which have a common interest in lime. A considerable amount of work is done through industrial fellowships in different institutions, this

work being directed jointly by the director of the Association and a representative of the institution concerned.

The data obtained are published and distributed among those interested, whether it be on lime for construction purposes, for agriculture, or for the chemical field.

Funds are secured by assessment on the product of each member in the organization, levied at so many cents per ton of lime produced, the amounts being fixed each year by members in convention assembled.

The Tanners' Council

The Tanners' Council of the United States of America includes nearly all the producers of various grades of leather. Previous to the war, a research laboratory was established which has since been reorganized upon a broader plane and encouraged to proceed with fundamental work as contrasted with service work on raw materials of one kind or another. The Council was instrumental in furthering a school where those in the industry might gain knowledge to make them better craftsmen. The council now has under consideration a comprehensive plan for the establishment of not only a school for craftsmen but for advanced students and for research through direct appropriations from council funds. An appropriation of $110,000 has been made recently for a new research laboratory.

The Refractories Manufacturers Association

The Refractories Manufacturers Association has been engaged in research for over five years, the original yearly appropriation having increased about 500 per cent. At first, only problems of general interest were studied and this policy was followed for about one year. At that time it became evident that many of the research problems of the various companies required special study. These studies can be made by following certain definite procedures, but the results are affected by operating conditions at the various plants.

The refractories industry, especially that branch which is devoted to the manufacture of fire-clay brick, does not work with a standard material. The physical properties of the clays vary as does the process of manufacture. It is this situation that limits the application of many of the results that may be obtained by research. Consequently, it was decided to make the research facilities of the Association available to the members by the payment of a fee necessary to cover the expense of an individual investigation. This latter field has been most profitable and popular, for the results are immediate and have a definite application. The experience gained by studying the same problem at different plants has been invaluable and often has made possible the expression of an opinion or

recommendation without additional study as the problem continues to arise.

There is an extremely large field in this industry for the study of conditions under which the product is used. As these studies progress certain facts become evident. In some cases, the product is used with shameful ignorance as to how it should be treated, yet when ultimate failure results it reflects upon the producer. Careful study has developed information on many of the evil practices that are common. On the other hand, certain raw materials cannot be used for many purposes; the shrinkage may be too high, the refractoriness too low, or the strength insufficient. In other cases, complete knowledge of service requirements enables the production of suitable ware.

An unforseen development of this plan has been in connection with matters of a more business-like nature. An accumulation of extensive data is of great benefit in many of the every day problems that come up, regarding specifications, tariff matters, trade development, and similar examples. The centralization of data regarding similar products permits the formulation of policies that would otherwise remain undeveloped under conditions where each manufacturer is forced to protect his own interests without knowing how others may be affected.

American Meat Packers Institute

The achievements of scientific research in the packing industry have become a classic and are often used to illustrate how exceedingly profitable research can be made in commerce. Every packing house of any consequence maintains a research and control laboratory. In view of these facts it is particularly interesting to note that a concerted movement has been initiated by the Institute of American Meat Packers looking toward the establishment of an Educational Institute. It is recognized that there is at present duplication of research work, that there is a limitation of research to such lines as may be expected to return a quick profit, that the individual companies—and there are 257 of them in the Institute—have their development limited by their own experience, that no effort has been made to systematize this industrial experience, and that the future is limited by the progress of the present. The industry is looking toward the establishment of a central distinctive home where technical men may be trained to succeed those now active in the packing industry, where by providing facilities for a broad training the executives of the future may not be specialists in such narrow fields as many departmental executives of the present régime are known to be.

The Institute is to become an organization which will combine the activities of a research institute, an educational center, a trade association,

and an industrial musuem. To quote from the plan submitted by the Institute Plan committee, of which Thomas E. Wilson is Chairman:

1. As a research institution, it should:
   - *a.* Develop and systematize a body of scientific and practical data for the service of the whole industry.
   - *b.* Carry on agreed researches into new scientific and practical problems common to all packers, without infringing on research along individual lines being done by specific companies.
   - *c.* Conduct experiments on the extension of products and reclamation of materials (except where such experiments would infringe on original work done by some individual company.
   - *d.* Collate and disseminate information concerning discoveries and developments having relation to the packing industry, without invading material developed by particular companies.
   - *e.* Conduct merchandising surveys and commercial research work.
   - *f.* Discover waste and means of eliminating it.
   - *g.* Test materials and equipment offered to the industry.
2. As an educational institution it should do at least three things.
   - *a.* Provide broad but specialized collegiate education for young men intending to enter the packing industry, just as the Colorado School of Mines provides such training for young men expecting to begin their work in the mining industry.
   - *b.* Furnish special training to intermediate sub-executives (prospective departmental heads) of promise already engaged in the industry.
   - *c.* Conduct a continuation school for plant employees and junior office help.
3. As a trade association, it should continue to do what the Institute is now doing in this direction.
4. As an industrial museum, it should provide space for permanent exhibits of models showing modern packing-house operations, specimens and processes; and it should rent out space for exhibits of materials of industrial value, and for a permanent exhibit of packing house machinery and supplies—a sort of scientific museum and centralized market place, a gigantic permanent show window, conveniently located (being at Chicago) where packers from all parts of the country may come and view samples before making purchases and installments.

Plans for Coöperative Research

Many other associations are engaged in coöperative research on plans as diversified as are the industries represented. Many associations prefer to use their own laboratories, man them, and direct the work. Other associations begin by supporting a fellowship at one or more of our uni-

versities. Some rely upon the excellent facilites of some of our commercial laboratories or consulting engineers. Others make existing laboratories in plants available for the problems assigned and may begin with a sort of informational clearing house on existing knowledge and the state of the art as disclosed by the literature. Societies themselves may be formed, like the American Bureau of Welding, and the Crop Protection Institute, where all interested may meet on common ground and apportion the work, oversee it, and through the means of committees obtain funds from members and conduct experiments without actually establishing a separate laboratory.

Another plan is that of coöperation with various government laboratories. Research associates are placed in these laboratories under the direction of the head of the bureau but with the program arranged with the assistance of an advisory committee representing the industry. At the Bureau of Standards in addition to research associates placed by single companies, scientists are maintained by the National Glass Containers Association, the Hollow Building Tile Association, Associated Tile Manufacturers, and the National Gypsum Association.

At the Bureau of Mines we find as coöperators a number of Chambers of Commerce, individual companies, universities, and public service corporations. The Southern Appalachian Coal Operators Association and the American Society of Heating and Ventilating Engineers also work with the Bureau of Mines. The Heavy Clay Products Associations and The Refractories Manufacturers have coöperated with the Bureau of Mines in an extensive survey of possible economies in kiln firing. In general the Bureau contributes the time of specialists, the equipment in housing, and other substantial assistance.

The results in all cases where government coöperation is involved are made public at the conclusion of the work.

The Forest Products Laboratory, the Department of Agriculture, and its various bureaus, and other government agencies are frequently available to organizations conducting research where the public good is involved.

Conclusion

It has been shown that research can be successfully conducted by the association plan, whether the association be composed of a small or a large number of individuals, that there is a precedent for nearly any type of association; and that there are many methods for securing research funds. In general these are based either upon the gross business done, the capitol stock, the number of employees, items of equipment, or the number of packages of products shipped. Voluntary contributions form another somewhat less uniform basis.

There are facilities and plans for carrying on a research program to suit any association activity, and a start can be had with a director of research who can survey the field, tabulate the problems and set up an informational clearing house, if funds are not available for a more extensive program. As money becomes available, fellowships can be established, special problems assigned to individual laboratories, and in time if desirable, a laboratory can be set up and maintained by the association for study exclusively upon its problems.

There is still another possibility. I refer to a technical society, such as the AMERICAN CERAMIC SOCIETY, coöperating directly with trade associations in planning, supervising, and even executing a carefully selected scientific program. The SOCIETY could in fact be the Ceramic Research Institute in which the several Ceramic Trade Associations could have a common interest and control, and the most economic directing of their technical and scientific problems. This would be employing a going organization, well organized, productive and rapidly growing in strength which the Ceramic Industries are even now supporting and governing. This would merely be employing that which the ceramic industries already have. The only thing necessary to make the AMERICAN CERAMIC SOCIETY directly and immediately available to the several ceramic trade associations is a change in the scheme of the SOCIETY organization and control of finances whereby the trade associations would be the controlling agents for their firm members, jointly with the several other ceramic interests which perhaps could not readily be represented through trade associations. This sharing in control of the affairs of the SOCIETY by trade associations could be arranged by constitutional provisions so that the individual members would gain rather than lose in their rights and benefits of membership. It would affect that happy union in service of the financial and the technical industrial executives.

WASHINGTON, D. C.

PAPERS AND DISCUSSIONS

LONGER LIFE OF OUR TANKS[1]

By C. A. Modes

What is meant by the life of a glass furnace?

It is the period of time during which a furnace will furnish a fixed tonnage of glass of quality that will permit a maximum production of articles which measure up to the standards required by the consumer. The producer's interest lay in the attainment of certain quality, clarity, luster and strength. Quantity production requires a working quality of the glass that will not slow down operations, and after the ware is made, will not be lost due to strains.

We shall consider only glass tanks operating under modern conditions, supplying glass to automatic machines. This operation is intensive, twenty-four hours of the day, and six to seven days of the week.

From the time the glass is given to the machines there must be no interruption of flow from the furnace. This condition demands that the temperatures must be kept constant while the raw materials are being brought into solution and that while the furnace is "under load" certain "working temperatures" must be maintained. The results to the glass in the bottle are serious with the most perfect batch if the proper temperatures are not maintained.

Money is invested in the construction of a furnace to produce the maximum number of pieces per twenty-four hours. Each piece has a fixed sale value which must cover such charges as tax, cost of construction, raw material, fuel, maintenance, labor, selling costs, etc. Given a furnace which will consistently furnish a given quantity of good glass per twenty-four hours there is a potential profit if it can be made to produce 110% or 115%. It is a tempting opportunity that soon brings about an overload. The larger quantity of raw material requires a larger heat input to maintain the required tank temperatures. Indeed the working temperatures must be higher if there is to be a shortening of the time interval between the introduction of raw materials and the drawing of refined glass. In this we may for a time succeed, then the results of overstraining and overheating of the tanks begin to show. The furnace has not withstood this more severe treatment. Another repair bill has to be paid. Production is halted which in turn may mean loss of customers. Will the year's profit and loss statement reflect the anticipated earnings from this over-burdening of the tank?

The question of how long a modern machine furnace should last is one that cannot be determined without careful consideration of all these relating factors. Some basic units of production will have to be adopted,

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Glass Division).

for example an average producing capacity of twenty-five tons of good glass every working day for a period of twelve months. In this standard schedule, allowance would have to be made for the time required to repair the furnace, and for the gradually decreasing furnace efficiency due to erosions of the materials, which would require heavier loads and more heat input when the furnace was first started. At the end of the twelve-month period just as good a glass and as good ware would have to be made from this furnace as at any time.

Careful record would have to be made of the construction, hourly temperatures, fuel used, glass produced, batch melted, temporary repairs, minor maintenance, etc. The time taken to heat from 70° to melting temperature and the methods used would have to be known. These conditions and practices vary quite widely in different glass plants, each operator believing his to be the only safe procedure. And they are justified in their opinions by the results they obtained but nevertheless without a standard basis of rating it is impossible to make comparisons on "life of tank."

Unfortunately, however, there are many influencing conditions and factors which cannot be forseen in the carrying out of the most exact procedure. Even when the furnace is rebuilt with satisfactory block the chances are it will not operate with the expected efficiency. We are confused and have nothing to offer but opinions in lieu of explanation and this is not the way to solve the question. The block-maker is blamed as is the builder and the operators. We try again. Somewhere in the construction and operation we varied widely from the specifications.

Two factories both using blocks of the same make, one is convinced that a 12-inch and 15-inch thick block is the best while the other believes a 10-inch and 12-inch block is the best. The first plant condemns the quality of the blocks on the basis of short life on the furnaces, while the second plant has success with the thinner blocks and produces more glass per square foot of melting surface than does the first plant, temperatures used by both being the same.

In a certain plant two furnaces are operated, one furnace by a thermal engineer using all the refinements and means of control possible. The other furnace of similar construction operated without these refined control devices, produces as much good glass per pound of fuel as does the first. In this case the furnace design and construction are the most effective factors and if given the same ratio of heat input and same charge of glass batch per day, their productiveness will be equal.

One attractive problem is the small amount of heat used in the actual melting of a pound of glass, the high heat loss at the exterior of the furnace, and suggestions of how to conserve more of the heat for glass making. The answer is proper insulation. There are certain portions of our fur-

naces that can be insulated without shortening the life of the furnace, and there are other portions which, if insulated, would rapidly deteriorate.

Recently I saw an attempt at insulation of the high temperature portion of the furnace. I would not recommend any one to repeat this experiment.

Makers of refractories frequently offer a new idea in shape, size or make of block as a cure for tank failures. Unfortunately the glassmaker must put the material to actual test before either the blockmaker or he knows the positive results. If it is a success the blockmaker is elated and tells the other glass makers; if a failure, he is silent and the glassmaker is sorry.

There is too much empiric in the production of tank blocks. Blockmakers, however, are sincere in their efforts to furnish the longest life blocks.

By "blocks" I mean blocks used below the glass line. The refractory material used in construction above this flux line if properly constructed, is not a factor in the life of the furnace. It is below the flux line where our troubles are had. The blocks above the glass line may be and in most cases should be of quite different materials than those used in the blocks with which the glass is in contact. This requires different clays and different mesh grog, which results in different density and coefficient of expansion. The blocks used in contact with the molten glass are made to withstand high temperatures and the erosive action of the batch materials. Careful attention must be given this portion of the furnace throughout the life of the furnace.

The reported "long life" of some furnaces is creditable to the furnace having been operated much under capacity and the "short life" of other furnaces is chargeable to poor construction or poor handling during the heating-up period.

Each plant has its problems and I cannot see the possibility of anyone making specific recommendations for longer life of furnaces until agreement is had on what the expected time a furnace should operate, and what shall be a normal quantity and quality production of glass. Decision can be made only by a group of reliable men conscientiously considering materials and construction. They would have to assemble a large amount of actual operating data. This would require time and the confidence of furnace operators.

Illinois Glass Co.
Alton, Illinois

DISCUSSION ON "EXACT NOTIONS OF FLUORINE ENAMELS"[1]

(Reply to J. E. Hansen's Discussion)

Charles Musiol: Mr. Hansen believes that no loss of SiO_2 is visible in his examples, notwithstanding the fact that the fluorine is entirely driven out as SiF_4 on which the calculations were made.

[1] C. Musiol, *Jour. Amer. Ceram. Soc.*, **7** [2], 105(1924).

Let us take again the analysis "A" and "C" and also "A" "Cx" given by Mr. Hansen and let us examine them after their transformation into "substractive" analysis, according to our method.

Let us first suppose that the analysis "A" should not have undergone any change; it should have remained "A." In consequence we should have:

$$\frac{\text{values of "A"}}{\text{values of "A"}} = 1$$

it is to say that these quotients would have remained equal to the unit.

TABLE I

	"A"	"C"	"Cx"	$\frac{\text{values "A"}}{\text{values "A"}}$	$\frac{\text{values "C"}}{\text{values "A"}}$	$\frac{\text{values "Cx"}}{\text{values "A"}}$
Na_2O	17.40	18.34	18.10	1	1.054	1.040
K_2O	1.69	1.78	1.79	1	1.054	1.059
CaO	5.59	5.89	5.93	1	1.054	1.060
MnO	1.03	1.08	1.09	1	1.050	1.058
CoO	1.14	1.20	1.21	1	1.053	1.061
B_2O_3	13.85	14.60	14.32	1	1.054	1.035
Al_2O_3	5.70	6.01	6.05	1	1.054	1.061
SiO_2	50.90	50.50	50.90	1	0.992	1.000
F_2	3.68	...	...	1	...	...
	101.55	100.00	100.00	...	...	...
$-O$	1.55	...	...	1	...	...
	100.00	100.00	100.00			

Let us look now at the quotients of the analysis "C" and "A" and of the analysis "Cx" and "A." We immediately see by the difference of the quotients that in the first case there is complete disappearance of fluorine and loss of SiO_2, and in the second case complete disappearance of fluorine, loss of SiO_2 and a feeble loss of Na_2O and of B_2O_3.

This proves without any doubt that the mere "chemical data" are not sufficient to conclude and that they may, without the mathematical proof, make the chemist the victim of his fallacy.

I think Mr. Hansen is wrong when he excludes the mathematical means from chemistry, for both methods must complete each other.

Any enamelist knows that any mixture of chemical products, applied to the enamel-batch, put into the melting-furnace consists of two parts:

1. The former, which gives the enamel generally represented by a molecular formula, and

2. The latter, which containing products such as water, organic bodies, different gases, etc., evaporates or disappears, forming perhaps new chemical combinations, and is not represented in the formula of the enamel.

My article only treats those phenomena which refer to the first part of

the enamel-batch, *i. e.*, to the enamel and it has not at all touched the question of the second part. Therefore, the statement that the "fluorine escapes as such," *i. e.*, from our enamel-formula, is correct.

What may occur with this fluorine in status nascendi when it gets into contact with the second part of the enamel-batch, is quite another question, not discussed by my article.

For this reason I am obliged to reject the sentence of the abstract expressing that "the fluorine disappears during the melting process as F_2," because I did not pen that myself.

To the question of Mr. Hansen as to where I obtain the oxygen to form the CaO of CaF_2, I wish to make reference to the reaction which takes place in submitting the fluorspar to red heat in a steam-atmosphere, according to the formula: $CaF_2 + H_2O = CaO + 2HF$.

The presence of water in any enamel-batch is to be found under the form of humidity, hydrated water, water of crystallization coming namely from the boracic compounds when the enamel is not boronless.

Let us take as examples the typical American enamels published not long ago by Mr. Wolfram:

100 kg. of ground-coat-batch at 32% borax contains 15 kg. cryst. water
100 kg. of white enamel batch at 25.5% borax contains 12 kg. cryst. water

These quantities of water are more than sufficient to satisfy the demand of oxygen which should be necessary for the substitution of the fluorine.

Whether the fluorine disappears under the form of SiF_4 or under any other form constitutes an academic question which may be of some curiosity to the chemist, but which is not useful at all for the enamelist. The vital question for the latter is to know whether or not the partial disappearance of the fluorine always involves a decrease of SiO_2, as certain chemists pretend.

H. H. Stephenson: Mr. Hansen has pointed out, I think very justly, the improbability of the element fluorine escaping. The following list includes most of the possibilities, some of them very remote and in fact hypothetical.

(*a*) From the enamel: SiF_4, BF_3, HF, NaF, KF, SnF_4, SbF_3, TiF_4, and their double compounds.

(*b*) From the atmosphere: The formation of a compound of F with O or N or both, nitrides, NOF, NH_4F.

(*c*) From fire gases, if present: The formation of a compound of F with a saturated or unsaturated carbon compound (cyanamides, etc.).

Before seriously considering (*b*) and (*c*), it would have to be shown that an enamel behaves differently when heated in a vacuum or in a quite indifferent gas to what it does in air. But in view of the fact that almost all of the elements present in an enamel are known to form nitrides at high temperatures, and that nitrides with H_2O form ammonia, the following

equations do not appear to me impossible as temporary and catalytic phenomena.

(1) $CaF_2 + N_2 + H_2O = CaO + 2NH_4F + N_2O_3$.

(2) NH_4F dissociates, the HF escaping or attacking SiO_2 or B_2O_3; and $2NH_3 + N_2O_3 = 2N_2 + 3H_2O$, as in the preparation of N from NH_4NO_2.

Thus one might look for HF, NH_3 and N_2O_3 in the exit gases.

In the (*a*) list, KF boils at 1458°C and NaF at 1705°C; temperatures far above the enamel burn. Their double compounds with other fluorides may be possible.

The problem however has been settled under actual industrial conditions in favor of SiF_4 (excepting BF_3). How does sodium silicofluoride come onto the market in fairly large quantities and at a reasonable price? Simply because it is a by-product of the artificial fertilizer industry. The phosphate rock contains enough silicates and fluorides as impurity to make the escape of SiF_4 noxious and therefore prohibited by law in most countries. It may be objected that this reaction is an acid reaction in presence of sulphuric acid, while the enamel conditions are alkaline. This is not strictly true. A glaze slip may be alkaline, but at high temperatures SiO_2 makes all kiln reactions acid reactions.

Thus SiF_4 and BF_3, formed directly or catalytically, remain the leading probabilities. A well-equipped spectographer would settle the matter in a few minutes (see "Practical Spectographic Analysis," No. 444, Bureau of Standards, Scientific Papers).

J. E. Hansen: With regard to Mr. Musiol's reply to my discussion of his paper on "Extract Notions of Fluorine Enamels," may I state that I have no wish to exclude mathematical interpretations from chemistry, but that the point which I wished to emphasize in that discussion, and which I still wish to emphasize is that the chemical analysis of the fritted enamel and any mathematical relationship which may exist between the constituents of the enamel in the raw batch and in the fritted condition *are not sufficient in themselves* to show *in what form* the volatile constituents of the batch escaped from it.

The possibilities for various chemical combinations to be formed in the melting of an enamel batch are so numerous, and are subject to such complexities, that even with a combination of chemical and mathematical relationships, no proof can be considered a real *proof* until it is substantiated with chemical data showing the quantity and composition of the gas evolved during the melting process.

Furthermore, all the enamel constituents, when in a molten or liquid state, have a certain vapor pressure, great or small, depending on their individual characteristics and upon the temperature of the smelting furnace. This vapor pressure results in volatilization losses of each and every material, to a greater or lesser extent, which in turn alters the chemical analy-

sis of the resultant fritted enamel, and likewise alters any mathematical relationships derived therefrom.

I am still unable to reconcile Mr. Musiol's statement that "fluorine escapes *as such*" (the italics are mine) with his denial that "the fluorine escapes during the melting process as F_2." Certainly according to the usage of the English language, "*as such*," in this case, can mean only "*as fluorine* (F_2)," and it cannot mean fluorine in combination with any other element.

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire-clay brick to spalling?
2. What difference is there between the properties of a soft mud machine made and a hand made brick?
3. What is the best method of sampling fine ground fire clay for testing? Discuss straight clay and cement mixtures.
4. Can a customer form any judgment of the quality of a shipment by a test made on one brick? If not, how many samples should be used?
5. Can an iron free clay brick be made for blast furnace service?
6. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?
7. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?
8. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand made fire brick?
9. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?
10. What is the reason for the more rapid failure, at a lower temperature, of fire brick subjected to reducing atmosphere, than will obtain with the same brick under oxidizing conditions?
11. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

Question

Does the grinding (coarse or fine) have anything to do with the resistance of a clay brick to spalling?

Discussion

There are certain finely ground fire brick that resist spalling very well and there are other coarsely ground fire brick that do not, but when other conditions are the same a coarsely ground brick has a higher resistance to spalling. The finely ground brick that stand up well are invariably made

from very refractory clays or clays that do not vitrify at the furnace temperature. The coarsely ground brick that spall badly usually have poor mechanical strength or else are made either from dense burning clays or clays of low refractoriness. The fine ground brick that stand up well can be improved in many cases by coarser grinding; the coarsely ground brick by increasing the strength in some cases or by reducing the content of dense burning clay in others.

I think it was mentioned that the coarse grain brick had a higher spalling than finer grain brick and when these bricks spall it tends to break up this thin film of coarse and a chunk of brick would fall out. This fine grade brick did not spall at all—it wore down very gradually until it was about one and one-half inches in thickness, red hot on the outside. These bricks were tested in an alkali furnace.—RAYMOND M. HOWE.

In almost every paper written on the manufacture of brick for use in malleable iron furnace bungs, it is stated that the best bricks for this purpose are of coarse grind, open texture and light burn. The grinding exerts a great influence on the resistance of a clay brick to spalling but the grain size should be within certain limits. Brick that are too coarse, spall just as readily as those that are too fine.

The following screen analyses are offered as evidence:

	(1) Per cent	(2) Per cent	(3) Per cent
Retained on No. 10 sieve	27.8	19.4	3.7
Retained on No. 20 sieve	18.7	19.8	22.4
Retained on No. 40 sieve	9.2	10.4	14.0
Retained on No. 60 sieve	4.7	5.2	7.4
Retained on No. 100 sieve	4.0	5.3	7.1
Passed through No. 100 sieve	35.6	39.9	45.4
	100.0	100.0	100.0

Samples No. 1 and No. 2 were made from the same type of clay by the soft mud, repress method and given the same heat treatment. Sample No. 3 was made from the same type clay by the dry press method.

Sample No. 1 gave about four heats in service.

Sample No. 2 gave about twenty-two heats in service.

Sample No. 3 gave thirty-three heats in service.

These results seem to indicate that coarse grinding is not the way to overcome spalling in brick made from Kentucky semi-flint clays.—C. E. BALES, Louisville Fire Brick Works.

In conducting some tests on kaolinitic fire clay we found that there was a difference. Those clays did not vitrify. We found that the difference between two bricks of exactly the same composition, one over an 8 mesh screen,

the other over a quarter mesh screen, without any effort to control the percentage except with the natural differentiation of a screen, would make that difference on exactly the same brick. In the average spalling test we only got 3 heats on the 8 mesh, where we got 15 on the quarter mesh.

The manufacturers of Pennsylvania brick are unanimous in saying that a coarse grain brick is the best resistance in spalling in service and in spalling tests besides.—A. F. GREAVES-WALKER, Stevens, Inc., Stevens Pottery, Ga.

It does not seem as though we should be expected to draw conclusions from one article. Perhaps in this case the coarse ground brick would give a very poor value, the mechanical strength being as big a factor in the failure as what you might term real spalling. It seems as though there is a pretty fine distinction there to determine whether the spalling is due to heating and cooling or whether it is due more to a squeezing, a pressure effect, that you might have. With Pennsylvania clays—there is no question but what a finely ground brick can be bolstered up by a coarse grinding; on the other hand with a clay such as the sandy clays of New York, I do not believe you could change their resistance to spalling a whole lot by changing the size of the grain—that is, in actual service, because those bricks are so low in impurities that vitrification probably does not take place very rapidly and when they finally go, they go with a bang. The New Jersey brick is pretty finely ground and they certainly can stand heating and cooling all right. So you get as many different results as you have methods and clays.—F. A. HARVEY, U. S. Refractories Corp., Mt. Union, Pa.

Question

What is the best method of sampling fine-ground fire clay for testing? Discuss straight clay and cement mixtures.

Discussion

In the case of very fine materials like clays and cements, we usually open, in a carload of cement for instance, about twenty-five bags. We have a long sort of a tube, we ram the tube away down into the bag and take a sample out with that tube. We take the twenty-five samples and mix them and pour it down to whatever we want to use it for, sieve tests, etc. In case of bulk shipments we do not get very much fine stuff, but when we do we bore down into the car. Of course it has to be more or less surface sample. We cannot go very deep. In the case of some of our chrome ores, we dig trenches from one end of the car to the other, and clear to the floor.—C. E. NESBITT, Carnegie Steel Co., Pittsburgh, Pa.

In the case of some refractory clays that we suspected of varying greatly, and to prove whether they did or not, for every tenth shovel full we took

for example an average producing capacity of twenty-five tons of good glass every working day for a period of twelve months. In this standard schedule, allowance would have to be made for the time required to repair the furnace, and for the gradually decreasing furnace efficiency due to erosions of the materials, which would require heavier loads and more heat input when the furnace was first started. At the end of the twelve-month period just as good a glass and as good ware would have to be made from this furnace as at any time.

Careful record would have to be made of the construction, hourly temperatures, fuel used, glass produced, batch melted, temporary repairs, minor maintenance, etc. The time taken to heat from 70° to melting temperature and the methods used would have to be known. These conditions and practices vary quite widely in different glass plants, each operator believing his to be the only safe procedure. And they are justified in their opinions by the results they obtained but nevertheless without a standard basis of rating it is impossible to make comparisons on "life of tank."

Unfortunately, however, there are many influencing conditions and factors which cannot be forseen in the carrying out of the most exact procedure. Even when the furnace is rebuilt with satisfactory block the chances are it will not operate with the expected efficiency. We are confused and have nothing to offer but opinions in lieu of explanation and this is not the way to solve the question. The block-maker is blamed as is the builder and the operators. We try again. Somewhere in the construction and operation we varied widely from the specifications.

Two factories both using blocks of the same make, one is convinced that a 12-inch and 15-inch thick block is the best while the other believes a 10-inch and 12-inch block is the best. The first plant condemns the quality of the blocks on the basis of short life on the furnaces, while the second plant has success with the thinner blocks and produces more glass per square foot of melting surface than does the first plant, temperatures used by both being the same.

In a certain plant two furnaces are operated, one furnace by a thermal engineer using all the refinements and means of control possible. The other furnace of similar construction operated without these refined control devices, produces as much good glass per pound of fuel as does the first. In this case the furnace design and construction are the most effective factors and if given the same ratio of heat input and same charge of glass batch per day, their productiveness will be equal.

One attractive problem is the small amount of heat used in the actual melting of a pound of glass, the high heat loss at the exterior of the furnace, and suggestions of how to conserve more of the heat for glass making. The answer is proper insulation. There are certain portions of our fur-

naces that can be insulated without shortening the life of the furnace, and there are other portions which, if insulated, would rapidly deteriorate.

Recently I saw an attempt at insulation of the high temperature portion of the furnace. I would not recommend any one to repeat this experiment.

Makers of refractories frequently offer a new idea in shape, size or make of block as a cure for tank failures. Unfortunately the glassmaker must put the material to actual test before either the blockmaker or he knows the positive results. If it is a success the blockmaker is elated and tells the other glass makers; if a failure, he is silent and the glassmaker is sorry.

There is too much empiric in the production of tank blocks. Blockmakers, however, are sincere in their efforts to furnish the longest life blocks.

By "blocks" I mean blocks used below the glass line. The refractory material used in construction above this flux line if properly constructed, is not a factor in the life of the furnace. It is below the flux line where our troubles are had. The blocks above the glass line may be and in most cases should be of quite different materials than those used in the blocks with which the glass is in contact. This requires different clays and different mesh grog, which results in different density and coefficient of expansion. The blocks used in contact with the molten glass are made to withstand high temperatures and the erosive action of the batch materials. Careful attention must be given this portion of the furnace throughout the life of the furnace.

The reported "long life" of some furnaces is creditable to the furnace having been operated much under capacity and the "short life" of other furnaces is chargeable to poor construction or poor handling during the heating-up period.

Each plant has its problems and I cannot see the possibility of anyone making specific recommendations for longer life of furnaces until agreement is had on what the expected time a furnace should operate, and what shall be a normal quantity and quality production of glass. Decision can be made only by a group of reliable men conscientiously considering materials and construction. They would have to assemble a large amount of actual operating data. This would require time and the confidence of furnace operators.

Illinois Glass Co.
Alton, Illinois

DISCUSSION ON "EXACT NOTIONS OF FLUORINE ENAMELS"[1]

(Reply to J. E. Hansen's Discussion)

Charles Musiol: Mr. Hansen believes that no loss of SiO_2 is visible in his examples, notwithstanding the fact that the fluorine is entirely driven out as SiF_4 on which the calculations were made.

[1] C. Musiol, *Jour. Amer. Ceram. Soc.*, **7** [2], 105(1924).

Let us take again the analysis "A" and "C" and also "A" "Cx" given by Mr. Hansen and let us examine them after their transformation into "substractive" analysis, according to our method.

Let us first suppose that the analysis "A" should not have undergone any change; it should have remained "A." In consequence we should have:

$$\frac{\text{values of "A"}}{\text{values of "A"}} = 1$$

it is to say that these quotients would have remained equal to the unit.

TABLE I

	"A"	"C"	"Cx"	$\frac{\text{values "A"}}{\text{values "A"}}$	$\frac{\text{values "C"}}{\text{values "A"}}$	$\frac{\text{values "Cx"}}{\text{values "A"}}$
Na_2O	17.40	18.34	18.10	1	1.054	1.040
K_2O	1.69	1.78	1.79	1	1.054	1.059
CaO	5.59	5.89	5.93	1	1.054	1.060
MnO	1.03	1.08	1.09	1	1.050	1.058
CoO	1.14	1.20	1.21	1	1.053	1.061
B_2O_3	13.85	14.60	14.32	1	1.054	1.035
Al_2O_3	5.70	6.01	6.05	1	1.054	1.061
SiO_2	50.90	50.50	50.90	1	0.992	1.000
F_2	3.68	...	...	1	...	...
	101.55	100.00	100.00	...	...	...
$-O$	1.55	...	...	1	...	...
	100.00	100.00	100.00			

Let us look now at the quotients of the analysis "C" and "A" and of the analysis "Cx" and "A." We immediately see by the difference of the quotients that in the first case there is complete disappearance of fluorine and loss of SiO_2, and in the second case complete disappearance of fluorine, loss of SiO_2 and a feeble loss of Na_2O and of B_2O_3.

This proves without any doubt that the mere "chemical data" are not sufficient to conclude and that they may, without the mathematical proof, make the chemist the victim of his fallacy.

I think Mr. Hansen is wrong when he excludes the mathematical means from chemistry, for both methods must complete each other.

Any enamelist knows that any mixture of chemical products, applied to the enamel-batch, put into the melting-furnace consists of two parts:

1. The former, which gives the enamel generally represented by a molecular formula, and

2. The latter, which containing products such as water, organic bodies, different gases, etc., evaporates or disappears, forming perhaps new chemical combinations, and is not represented in the formula of the enamel.

My article only treats those phenomena which refer to the first part of

the enamel-batch, *i. e.*, to the enamel and it has not at all touched the question of the second part. Therefore, the statement that the "fluorine escapes as such," *i. e.*, from our enamel-formula, is correct.

What may occur with this fluorine in status nascendi when it gets into contact with the second part of the enamel-batch, is quite another question, not discussed by my article.

For this reason I am obliged to reject the sentence of the abstract expressing that "the fluorine disappears during the melting process as F_2," because I did not pen that myself.

To the question of Mr. Hansen as to where I obtain the oxygen to form the CaO of CaF_2, I wish to make reference to the reaction which takes place in submitting the fluorspar to red heat in a steam-atmosphere, according to the formula: $CaF_2 + H_2O = CaO + 2HF$.

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Before seriously considering (*b*) and (*c*), it would have to be shown that an enamel behaves differently when heated in a vacuum or in a quite indifferent gas to what it does in air. But in view of the fact that almost all of the elements present in an enamel are known to form nitrides at high temperatures, and that nitrides with H_2O form ammonia, the following

equations do not appear to me impossible as temporary and catalytic phenomena.

(1) $CaF_2 + N_2 + H_2O = CaO + 2NH_4F + N_2O_3$.

(2) NH_4F dissociates, the HF escaping or attacking SiO_2 or B_2O_3; and $2NH_3 + N_2O_3 = 2N_2 + 3H_2O$, as in the preparation of N from NH_4NO_2.

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J. E. Hansen: With regard to Mr. Musiol's reply to my discussion of his paper on "Extract Notions of Fluorine Enamels," may I state that I have no wish to exclude mathematical interpretations from chemistry, but that the point which I wished to emphasize in that discussion, and which I still wish to emphasize is that the chemical analysis of the fritted enamel and any mathematical relationship which may exist between the constituents of the enamel in the raw batch and in the fritted condition *are not sufficient in themselves* to show *in what form* the volatile constituents of the batch escaped from it.

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What is the best method of sampling fine-ground fire clay for testing? Discuss straight clay and cement mixtures.

Discussion

In the case of very fine materials like clays and cements, we usually open, in a carload of cement for instance, about twenty-five bags. We have a long sort of a tube, we ram the tube away down into the bag and take a sample out with that tube. We take the twenty-five samples and mix them and pour it down to whatever we want to use it for, sieve tests, etc. In case of bulk shipments we do not get very much fine stuff, but when we do we bore down into the car. Of course it has to be more or less surface sample. We cannot go very deep. In the case of some of our chrome ores, we dig trenches from one end of the car to the other, and clear to the floor.—C. E. Nesbitt, Carnegie Steel Co., Pittsburgh, Pa.

In the case of some refractory clays that we suspected of varying greatly, and to prove whether they did or not, for every tenth shovel full we took

out a small shovel full, like a hand sample of material, and threw it aside—just loading out of a box car. That resulted in about four barrels of clay to the carload. We sampled that down and seemed to be able to catch it pretty well that way and it did not entail much loss. Loading in wheelbarrows, loading out of the car, they took just a small shovel full and dropped it into a barrel at the end of the car.

CHAIRMAN: Was that ground clay?

MR. ROSS: Some of it was as large as two inches.

CHAIRMAN: Was the sample representative or did the man who took that sample get more lumps than anything else?

MR. ROSS: I stayed on the job for three cars myself and got two men trained so that they would follow pretty well. They did not take lumps—they took average of the material. It ran some but not very much. —D. W. ROSS, Washington Clay Pot. Co., Washington, Pa.

CHAIRMAN: In the shipment of such materials as ground ganister which have various percentages of clay in them for patching and bottom work, the clay goes to the bottom of the car and when it is unloaded very often the material is separated enough so that the mixture in the top of the car has not sufficient clay for plasticity and that at the bottom has a very low fusion compared to what is required. Every manufacturer has his own method of taking care of that. Sometimes it amounts to a bad complaint and expense but on the average I do not think it is customary to caution the consumer about the handling of that clay.

MR. HARVEY: It seems to me the only method which would be fair, of settling that, would be the one suggested by Mr. Ross, by which you take a small portion out of every tenth shovel full or wheelbarrow load, or however it is you are emptying the car.

MR. WALKER: Mr. Harvey has had a great deal of experience in materials of that kind. Couldn't he say something about it?

MR. HARVEY: I am responsible for that question. I wanted to bring out exactly what has been brought out by Mr. Nesbitt, that in the case of bulk shipments it is usually surface sampling.

In loading a car of finely ground material you have, of course, a mixture running from 8 mesh, or 30 mesh, down to 200 mesh. The coarse stuff will run off the surface of that car and you get a bigger proportion of coarse material. The test on that sample will be entirely misleading as to the average content of the car. We have recently developed a method at our own plant which is simpler than the one Mr. Nesbitt uses in the case of bag shipments. We have made a tube about eight feet long which is split along one side the entire length and has a handle through it. We go over the top of the car, push the tube clear to the bottom of the car, give it a full turn and pull it out and use that as an average sample, a cross-section,

at that particular place in the car. I do not know whether that is the final answer on sampling bulk shipments—it possibly is not, but certainly it is much better than getting a surface sample of a car of fine ground material.

If possible, a small amount of the fire clay should be taken at regular intervals as the car is being loaded at the manufacturer's plant. This should then be averaged and about a 10-pound sample taken for testing purposes.

If sample has to be taken after shipment, about twelve samples should be taken from different parts of the car and at least a foot below the surface. These are mixed, and a small sample for testing taken from the average.—E. N. McGee, The Semet-Solvay Co., Syracuse, N. Y.

Mr. Phelps: We have in our laboratory what we call medium sample. We make borings in the top and vibrate those borings in a bottle by an electric vibrator. We vibrate each boring. We set the bottles along in a row and we can get a medium sample. We used tall bottles small in diameter. We take the center of the borings from the car, place them in the bottle and fill the bottle with water. We set the bottle on the top of the electic vibrator, hold the top of the bottle with the hand. The vibration is the same but a very quick medium. The finer will come to the top, medium fine stay to the center, and sometimes we get as many as six separations. We can take those vibrations with a rule and can get what we think is a good test. It takes about half an hour to settle clear up. We have made vibration tests where we could even separate the iron. In that way you can derive a sample for testing which is a fairly good one.

We use that vibrating sample then for the analysis. We make six vibration tests to a car. There may be some variation. We get the nearest and best mixture from the average.

Mr. Harvey: That method would not be at all suitable for mixtures of silica cement or for finely ground fire clay in which you put a certain percentage of calcine. For example, the calcine does not grain as fine as the soft clay unless it is ground separately and your vibrator method would separate the calcine, put it at the bottom—whichever goes to the bottom—and any sample that you took from the center of the tube would not be representative of the shipment.

Question

Can a customer form any judgment of the quality of a shipment by a test made on one brick? If not, how many samples should be used?

Discussion

Mr. Nesbitt: The final analysis is what you get out of service. We cannot test all the brick we get. We have to start some place. We

usually select ten brick out of ten thousand as a representative sample. We get a car of fifteen thousand brick and we take fifteen brick. We try to get good representative brick, we try not to pick the worst or the best. That is our method at the present time.

CHAIRMAN: Do you find that method gives you satisfactory tests which check the service you expect?

MR. NESBITT: We have gone over failures in furnaces and run various tests on them and we find some tests indicate when the service is going to be good and when it is going to be bad. We have found that we can foretell whether this carload of brick is going to give an average life service or whether it is going to be a true failure. We do not say we can do that all the time, but it indicates.

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MR. HARVEY: Are we to take from this, then, the assumption that one brick does not give us any result? I think that perhaps is what was intended to be brought out here. Every manufacturer frequently runs into complaints and when he traces them down he finds perhaps only one brick out of a shipment has been tested.

MR. NESBITT: Mr. Harvey, I said ten brick out of ten thousand. Ten brick is our minimum.

MR. HARVEY: But this question says—Is one brick from a shipment satisfactory?

MR. NESBITT: Absolutely no.

One method which we have been using is when we receive a carload of brick which looks as though it might be desirable, we take out about twice as many brick as we expect to test. We test the other half and send back to the manufacturer one-half if our own tests do not look satisfactory so we have the manufacturer checking us as well as our check on the manufacturer.—C. P. SPANGLER, Jones-Laughlin Steel Co., Pittsburgh, Pa.

A customer cannot judge a shipment of fire brick by a test of one brick. It is difficult to determine exactly how many brick should be tested, but the results of investigation made by Committee C-8 of the American Society for Testing Materials would indicate from ten to twelve. This, however, is usually impossible where shipments are numerous. In most cases, three or four bricks, picked at random, for each test will give a fair idea of the quality of the shipment.—E. N. McGEE, The Semet-Solvay Co., Syracuse, N. Y.

ACTIVITIES OF THE SOCIETY

PRESIDENT'S PAGE

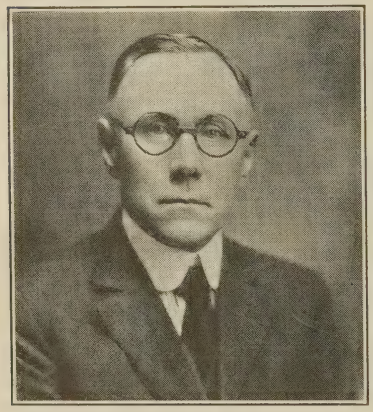
By Robert D. Landrum

August Staudt, Vice-President

The Board of Trustees of the American Ceramic Society announce the appointment of August Staudt of Perth Amboy, N. J., as successor to Raymond M. Howe as vice-president of the Society. This appointment came as a unanimous decision of the Board. The following sketch is taken from the History of Middlesex County, New Jersey, published 1921.

Captains and leaders of industry in their respective lines almost invariably are self-made men. Their lives blend closely with romance, giving an inspiring example of just what energy, perseverance and ability can accomplish. Success becomes part of their everyday activities, and each year is like a stepping stone to still greater and more pronounced achievements.

August K. Staudt stands prominent among the leading citizens of Perth Amboy, New Jersey, and a brief résumé of his life reflects well-earned regards in his chosen field. Tireless energy and broad public-spirited benevolence have been the keynotes of his success, and his notable progress in local circles indicates still more marked distinction in his activities in the time to come. His career is an inspiration.



August Staudt

He was born in Nuremberg, Bavaria, Germany, on December 6, 1869. He was the second child of Conrad and Rosa Staudt in a family of eight children, four boys and four girls. Receiving his education in Germany, and satisfactorily fulfiling his military duties in the Bavarian army, he left his native land in 1891. The five years following were spent in England, America and France, and in this time Mr. Staudt perfected his training as a correspondent in foreign languages.

Upon his return to Nuremberg in 1896, Mr. Staudt became connected with a large local industry, and a year later in 1897, married Katherine P. Vorgang, of Brooklyn, New York, whom he had met on his visit to America and who, in the year noted, was visiting relatives in Germany. Mr. Staudt was soon made superintendent of the Nuremberg factory, but relinquished this position in 1901 to take up a residence with Mrs. Staudt in America.

After occupying a number of important positions in banks and commercial houses, Mr. Staudt associated himself with the Perth Amboy Tile Works, and became a resident of this city. The plant at that time was practically unknown and quite insignificant while the company itself had just been reorganized. It was not long before unexpected difficulties arose, and in order to safeguard the investment he had made, Mr. Staudt was compelled to assume the full management of the small tile factory. He was undismayed, however, despite the fact that his working knowledge of ceramics was quite meager, and with grim determination he resolved to build up the establishment, if possible in any way, and make it one of the successful enterprises of the community.

He took a hand in affairs immediately, donning his overalls and tackling any job that needed to be done. Nothing was too hard for it was a case of necessity and resolve—the plant must flourish. Mr. Staudt established a definite working policy for the organization. He rebuilt what remained of the little defunct plant on the solid foundation of honor and integrity in business—the best products at the right price, and the same treatment of every customer, whether large or small. These principles live with the business now, just as they did in the early days, and they are one of the secrets of the remarkable success which the industry has attained.

Step by step the business thrived and then came into its own. The success has been spectacular, and due to the guiding hand and persevering energy of Mr. Staudt, the plant was developed and extended from year to year, and today occupies a position as one of the most modern and best equipped ceramic plants in the State of New Jersey. The floor space has grown from 6784 square feet to close to 42,000 square feet, more than six-fold; even now, the capacity is taxed to the utmost to furnish the demands of customers, and still more expansion will be necessary in the future.[1] Mr. Staudt can well take pride in this achievement, for with the plant he has grown to enjoy an enviable position among the leading business men in the state. In his treatment of his employees he has shown that he has at heart their utmost welfare and security; he has assisted them to purchase homes for their families, arranging large yearly bonuses for faithfully performed duties. Moreover, he has taken out a large block of building and loan stock for operatives at the plant without their knowledge, and which, when due, will be given to deserving employees.

Mr. Staudt has been a member of the American Ceramic Society, since 1911; past president of the New Jersey Clay Workers' Association and Eastern Section of the American Ceramic Society, and has long occupied a position on the board of directors of the latter organization. He is a thirty-second degree Mason, a member of the East Jersey Club, Raritan Yacht Club, Elks Club and other well-known organizations. His name will also be found in the membership list of many worthy societies, giving them the benefit of his support and influence.

Mr. and Mrs. Staudt have one child, Augusta, who was born in Newark, New Jersey, August 16, 1906. The family are members of the Evangelical Lutheran Church.

Dr. Julius Grünwald

The members of the Enamel Division will regret indeed to learn of the death of Dr. Julius Grünwald on April 11, 1924. Dr. Grünwald has done a great deal for the enameling industry, and especially for the enameling industry in this country and England, since his treatises on enameling were the first to be translated into English. The Enamel Division of the American Ceramic Society two years ago awarded Dr. Grünwald a purse for the work he had done for enameling.

"Dr. Ing. Julius Grünwald, born in Vienna on April 23, 1873, came from humble parents. He spent the first years of his life at Steyr (Upper-Austria) continuing his studies at Linz where he finished them in 1891. In the following 5 years he was immatriculated at the Technical High School at Vienna and Brunn, leaving that school in 1897 and taking a position as assistant to the University of Brunn (general chemistry). He then also had a position in the Enameling Works and Metal Manufacturers "Austria" at Brux and Brunn.

[1] Present floor space 79,124 sq. ft. plus 7 sixteen-foot kilns, Jan. 2, 1924.

From 1901–1905 he was engineer in the greatest European Enameling Works Thale at the Harz (Germany). In 1905 he took a position as director of the great enameling work Japy Freres and Co., Lafeschotte (France), from 1912 he entered on a regular course of correspondence with French, English and American, Swiss and other enameling works. He fluently spoke French, English, German, Czech and Hungarian. Though working for the benefit of the works he was connected with and doing a great amount of private scientific writing he nevertheless devoted his spare time for preparing himself for his final examinations writing a dissertation (New Methods for Pickling and Glowing of Steel and Iron) to take his degree which he did in 1910. He then was appointed technical chemist and sworn expert of the enameling industry to the Austrian Board of Trade. In 1913 he became sworn interpreter for French with the Court of justice in Vienna. At the International exhibition at Nancy he received the Great Golden Medal and received the title of an officer in the French Academy (Paris).

Dr. Julius Grünwald.

During the war he acted as expert at the "Metallzentrale" (State Organization for Metal Goods). Thereafter he established himself at his own office in the center of the town doing much investigatory work furthering the ends which are also the object of this society carrying on an enormous amount of correspondence with enameling works, societies and friends in all parts of the world. He married in 1919.

But his physical being could not stand the stress of many years strenuous, incessant work, the more so as he never would hear of rest and repose. So at last it gave way, terrible fits at intervals took their grip upon him and on April 11th while walking home an apoplexy struck him down in the street."

Besides publishing articles on enameling in every journal and trade paper in Germany, and in foreign journals including our own, Dr. Grünwald is the author of the following books which have been translated into many languages:

"Theory and Practice of Enameling on Iron and Steel," "The Technology of Iron Enameling and Tinning," "Chemical Technology of the Enamel Raw-Materials." Your President especially feels the loss of Dr. Grünwald, for Dr. Grünwald was a warm personal friend of his, and for many years he has been in close touch with Dr. Grünwald's work.

THAT ANNUAL MEMBERSHIP INVENTORY

We told you in the May *Journal* that May 1st was the time of taking a physical inventory of members and dropping of the "no response" group. This sort of pruning is always good for the plant—but my, how we hate it.

The total number of members shown on the membership curve for 1923 was 2241. This means that our net loss in number of members since December 14 is 118.

It is evident that we shall have to have Miss Norah Binns manage this field event. At this season she would be having a whole flock of home runs, boggie scores and nine-second sprinters. She was a most winsome promoter. Under her inspiration there were wins for all and then some. It is safe to believe that as she scans this page she

will be sorely tempted to forsake her "Box of Books" in little old Alfred and return again to the game.

Here is the count to date:

	Personal	Corporation	Total
Net Roster April 14	2020	300	2320
Dropped	209	12	
Net Roster May 14	1811	288	2099
New Members	25	4	
	1836	292	
Resigned	4	1	
Changed to Corporation Member	1		
Net Roster May 14	1831	291	2122

The gross acquisitions in members last year were 452 persons and 85 corporations. The gross acquisitions for 1924 so far by months are:

	Personal	Corporation	Total
January	31	6	37
February	40	8	48
March	29	0	29
April	35	3	38
May	25	4	29
	160	21	181

This means that if last year's record is to be equalled we will have to interest at least 291 more persons and 64 more corporations. 42 personals and 10 corporations per month will turn the trick and bring satisfaction to Miss Binns. Will you do your best?

NEW MEMBERS RECEIVED FROM APRIL 15 TO MAY 15

PERSONAL

Blackburn, H. A., 1450 Rockway Ave., Lakewood, Cleveland, Ohio, Norton Co. Sales.

Blatt, S. F., Prizer-Painter Stove Works, Reading, Pa.

Bonesteele, Sarah H., Victor, N. Y.

Boyne, P. K., 33 Beresford Ave., Highland Park, Detroit, Mich., Ford Motor Co.

Collings, William Arthur, P. O. Box 286, Santa Monica, Calif., Manager, W. A. Collings Co.

Crumley, F. S., 407 Johnson Street, Hammond, Ind., President, Indiana Sanitary Pottery Co.

Ekstrand, E. W., 786 E. Washington, Los Angeles, Calif., Engineer, Whiting-Mead Pottery Co.

Gill, Francis D., % Gill Glass Co., Philadelphia, Pa., President.

Johnson, A. G., 116 Hyland Ave., Ames, Iowa (Student).

Kauffmann, Otto Adolf, Niedersedlitz, Sa., Germany, Partner of Chemische Fabrik, etc.

Kelly, Walter H., Bethlehem Steel Co., Bethlehem, Pa., Refractory Engineer.

Kern, Edward F., % School of Mines, Columbia University, New York City.

Kuechler, Adolph H., 50 Richards Road, Columbus, Ohio (Student).
Maguire, Joseph, 440 Martel St., Bethlehem, Pa. (Student).
Murray, Ernest L., 43 Lewis Street, Perth Amboy, N. J., Plant No. 2, Atlantic Terra Cotta Co.
Nichols, Mrs. George, Syosset, Long Island, N. Y., Syosset Pottery.
Ouffner, Abiram A., 107 Milford St., Mount Union, Pa., Harbison-Walker Ref. Co.
Pegram, James, Carrollton, Ill., Pegram Clay Co.
Peterson, T. J., President Tamms Silica Co., 30 N. La Salle St., Chicago, Ill.
Schmid, Fred, 395 Riley Street, Buffalo, N. Y., Clay Salesman, Butler Clay Co.
Stilson, Alden E., U. S. Bureau of Mines, Ceramic Experiment Station, Columbus, O.
Suydam, Albert G., 405 Hobart Bldg., San Francisco, Cal., Pacific Coast representative, Harbison-Walker Refractories Co.
Tombaugh, R. S., Waukegan, Ill., Chief Engineer, Franklyn R. Muller, Inc.
Weaver, Harry F., Evansville, Ind., Secy., and Gen. Mgr., National-Helfrich Potteries Co.
Zandstra, J. J., % Harshaw, Fuller & Goodwin Co., 107 N. Market Street, Chicago Ill., Salesman.

CORPORATION

Cambridge Sanitary Mfg. Co., D. Keith McAfee, Vice-President, Cambridge, Ohio.
The Ceramist, L. R. W. Allison, Editor, 170 Roseville Ave., Trenton, N. J.
Lancaster Iron Works, Inc., Jas. P. Martin, Mgr., Lancaster, Pa.
Pacific Stoneware Co., Thomas S. Mann, 695 Sherlock Ave., N., Portland, Ore.

Membership Worker's Record for May

	Personal	Corporation		Personal	Corporation
L. R. W. Allison		1	W. G. Owen	1	
Paul E. Cox	2		W. F. Rochow	1	
M. A. Gesner	1		Chas. W. Saxe	1	
Ralph E. Hanna	1		Mary G. Sheerer	1	
F. A. Harvey	1		R. R. Shively	1	
H. A. Huisken	1		F. W. Walker, Jr.	1	
Roy A. Horning.		1	W. W. Wilkins	3	
Walter M. Hughes	1		Office	8	1
T. S. Mann		1		—	–
R. L. McGean	1			25	4

PITTSBURGH LOCAL SECTION

The Pittsburgh Section of the American Ceramic Society held their regular monthly meeting on Friday evening, May 16, at the Bureau of Mines, Forbes Street, Pittsburgh, Pa. This meeting was one of the most enthusiastic and profitable of any which this Section has held. Following a cafeteria dinner at 7 P.M. the following program was given.

Henry M. Taylor, of the H. C. Fry Co., of Rochester, who is conducting experiments on the dielectric properties of special glass, talked on the development of heat-resisting glass. Examples were shown of high-voltage insulators, sparking plugs and oven ware.

E. H. McClelland, Technician and Librarian of the Technology Department of

out a small shovel full, like a hand sample of material, and threw it aside—just loading out of a box car. That resulted in about four barrels of clay to the carload. We sampled that down and seemed to be able to catch it pretty well that way and it did not entail much loss. Loading in wheelbarrows, loading out of the car, they took just a small shovel full and dropped it into a barrel at the end of the car.

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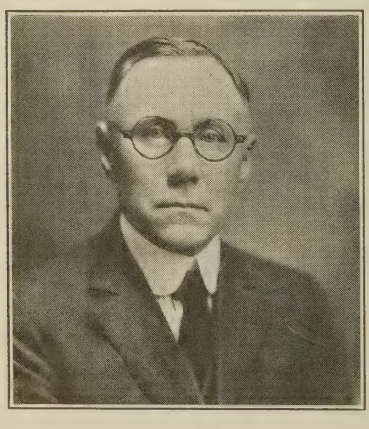

August Staudt

He was born in Nuremberg, Bavaria, Germany, on December 6, 1869. He was the second child of Conrad and Rosa Staudt in a family of eight children, four boys and four girls. Receiving his education in Germany, and satisfactorily fulfiling his military duties in the Bavarian army, he left his native land in 1891. The five years following were spent in England, America and France, and in this time Mr. Staudt perfected his training as a correspondent in foreign languages.

Upon his return to Nuremberg in 1896, Mr. Staudt became connected with a large local industry, and a year later in 1897, married Katherine P. Vorgang, of Brooklyn, New York, whom he had met on his visit to America and who, in the year noted, was visiting relatives in Germany. Mr. Staudt was soon made superintendent of the Nuremberg factory, but relinquished this position in 1901 to take up a residence with Mrs. Staudt in America.

After occupying a number of important positions in banks and commercial houses, Mr. Staudt associated himself with the Perth Amboy Tile Works, and became a resident of this city. The plant at that time was practically unknown and quite insignificant while the company itself had just been reorganized. It was not long before unexpected difficulties arose, and in order to safeguard the investment he had made, Mr. Staudt was compelled to assume the full management of the small tile factory. He was undismayed, however, despite the fact that his working knowledge of ceramics was quite meager, and with grim determination he resolved to build up the establishment, if possible in any way, and make it one of the successful enterprises of the community.

He took a hand in affairs immediately, donning his overalls and tackling any job that needed to be done. Nothing was too hard for it was a case of necessity and resolve—the plant must flourish. Mr. Staudt established a definite working policy for the organization. He rebuilt what remained of the little defunct plant on the solid foundation of honor and integrity in business—the best products at the right price, and the same treatment of every customer, whether large or small. These principles live with the business now, just as they did in the early days, and they are one of the secrets of the remarkable success which the industry has attained.

Step by step the business thrived and then came into its own. The success has been spectacular, and due to the guiding hand and persevering energy of Mr. Staudt, the plant was developed and extended from year to year, and today occupies a position as one of the most modern and best equipped ceramic plants in the State of New Jersey. The floor space has grown from 6784 square feet to close to 42,000 square feet, more than six-fold; even now, the capacity is taxed to the utmost to furnish the demands of customers, and still more expansion will be necessary in the future.[1] Mr. Staudt can well take pride in this achievement, for with the plant he has grown to enjoy an enviable position among the leading business men in the state. In his treatment of his employees he has shown that he has at heart their utmost welfare and security; he has assisted them to purchase homes for their families, arranging large yearly bonuses for faithfully performed duties. Moreover, he has taken out a large block of building and loan stock for operatives at the plant without their knowledge, and which, when due, will be given to deserving employees.

Mr. Staudt has been a member of the American Ceramic Society, since 1911; past president of the New Jersey Clay Workers' Association and Eastern Section of the American Ceramic Society, and has long occupied a position on the board of directors of the latter organization. He is a thirty-second degree Mason, a member of the East Jersey Club, Raritan Yacht Club, Elks Club and other well-known organizations. His name will also be found in the membership list of many worthy societies, giving them the benefit of his support and influence.

Mr. and Mrs. Staudt have one child, Augusta, who was born in Newark, New Jersey, August 16, 1906. The family are members of the Evangelical Lutheran Church.

Dr. Julius Grünwald

The members of the Enamel Division will regret indeed to learn of the death of Dr. Julius Grünwald on April 11, 1924. Dr. Grünwald has done a great deal for the enameling industry, and especially for the enameling industry in this country and England, since his treatises on enameling were the first to be translated into English. The Enamel Division of the American Ceramic Society two years ago awarded Dr. Grünwald a purse for the work he had done for enameling.

"Dr. Ing. Julius Grünwald, born in Vienna on April 23, 1873, came from humble parents. He spent the first years of his life at Steyr (Upper-Austria) continuing his studies at Linz where he finished them in 1891. In the following 5 years he was immatriculated at the Technical High School at Vienna and Brunn, leaving that school in 1897 and taking a position as assistant to the University of Brunn (general chemistry). He then also had a position in the Enameling Works and Metal Manufacturers "Austria" at Brux and Brunn.

[1] Present floor space 79,124 sq. ft. plus 7 sixteen-foot kilns, Jan. 2, 1924.

From 1901–1905 he was engineer in the greatest European Enameling Works Thale at the Harz (Germany). In 1905 he took a position as director of the great enameling work Japy Freres and Co., Lafeschotte (France), from 1912 he entered on a regular course of correspondence with French, English and American, Swiss and other enameling works. He fluently spoke French, English, German, Czech and Hungarian. Though working for the benefit of the works he was connected with and doing a great amount of private scientific writing he nevertheless devoted his spare time for preparing himself for his final examinations writing a dissertation (New Methods for Pickling and Glowing of Steel and Iron) to take his degree which he did in 1910. He then was appointed technical chemist and sworn expert of the enameling industry to the Austrian Board of Trade. In 1913 he became sworn interpreter for French with the Court of justice in Vienna. At the International exhibition at Nancy he received the Great Golden Medal and received the title of an officer in the French Academy (Paris).

Dr. Julius Grünwald.

During the war he acted as expert at the "Metallzentrale" (State Organization for Metal Goods). Thereafter he established himself at his own office in the center of the town doing much investigatory work furthering the ends which are also the object of this society carrying on an enormous amount of correspondence with enameling works, societies and friends in all parts of the world. He married in 1919.

But his physical being could not stand the stress of many years strenuous, incessant work, the more so as he never would hear of rest and repose. So at last it gave way, terrible fits at intervals took their grip upon him and on April 11th while walking home an apoplexy struck him down in the street."

Besides publishing articles on enameling in every journal and trade paper in Germany, and in foreign journals including our own, Dr. Grünwald is the author of the following books which have been translated into many languages:

"Theory and Practice of Enameling on Iron and Steel," "The Technology of Iron Enameling and Tinning," "Chemical Technology of the Enamel Raw-Materials." Your President especially feels the loss of Dr. Grünwald, for Dr. Grünwald was a warm personal friend of his, and for many years he has been in close touch with Dr. Grünwald's work.

THAT ANNUAL MEMBERSHIP INVENTORY

We told you in the May *Journal* that May 1st was the time of taking a physical inventory of members and dropping of the "no response" group. This sort of pruning is always good for the plant—but my, how we hate it.

The total number of members shown on the membership curve for 1923 was 2241. This means that our net loss in number of members since December 14 is 118.

It is evident that we shall have to have Miss Norah Binns manage this field event. At this season she would be having a whole flock of home runs, boggie scores and nine-second sprinters. She was a most winsome promoter. Under her inspiration there were wins for all and then some. It is safe to believe that as she scans this page she

will be sorely tempted to forsake her "Box of Books" in little old Alfred and return again to the game.

Here is the count to date:

	Personal	Corporation	Total
Net Roster April 14	2020	300	2320
Dropped	209	12	
Net Roster May 14	1811	288	2099
New Members	25	4	
	1836	292	
Resigned	4	1	
Changed to Corporation Member	1		
Net Roster May 14	1831	291	2122

The gross acquisitions in members last year were 452 persons and 85 corporations. The gross acquisitions for 1924 so far by months are:

	Personal	Corporation	Total
January	31	6	37
February	40	8	48
March	29	0	29
April	35	3	38
May	25	4	29
	160	21	181

This means that if last year's record is to be equalled we will have to interest at least 291 more persons and 64 more corporations. 42 personals and 10 corporations per month will turn the trick and bring satisfaction to Miss Binns. Will you do your best?

NEW MEMBERS RECEIVED FROM APRIL 15 TO MAY 15

PERSONAL

Blackburn, H. A., 1450 Rockway Ave., Lakewood, Cleveland, Ohio, Norton Co. Sales.

Blatt, S. F., Prizer-Painter Stove Works, Reading, Pa.

Bonesteele, Sarah H., Victor, N. Y.

Boyne, P. K., 33 Beresford Ave., Highland Park, Detroit, Mich., Ford Motor Co.

Collings, William Arthur, P. O. Box 286, Santa Monica, Calif., Manager, W. A. Collings Co.

Crumley, F. S., 407 Johnson Street, Hammond, Ind., President, Indiana Sanitary Pottery Co.

Ekstrand, E. W., 786 E. Washington, Los Angeles, Calif., Engineer, Whiting-Mead Pottery Co.

Gill, Francis D., ℅ Gill Glass Co., Philadelphia, Pa., President.

Johnson, A. G., 116 Hyland Ave., Ames, Iowa (Student).

Kauffmann, Otto Adolf, Niedersedlitz, Sa., Germany, Partner of Chemische Fabrik, etc.

Kelly, Walter H., Bethlehem Steel Co., Bethlehem, Pa., Refractory Engineer.

Kern, Edward F., ℅ School of Mines, Columbia University, New York City.

Kuechler, Adolph H., 50 Richards Road, Columbus, Ohio (Student).
Maguire, Joseph, 440 Martel St., Bethlehem, Pa. (Student).
Murray, Ernest L., 43 Lewis Street, Perth Amboy, N. J., Plant No. 2, Atlantic Terra Cotta Co.
Nichols, Mrs. George, Syosset, Long Island, N. Y., Syosset Pottery.
Ouffner, Abiram A., 107 Milford St., Mount Union, Pa., Harbison-Walker Ref. Co.
Pegram, James, Carrollton, Ill., Pegram Clay Co.
Peterson, T. J., President Tamms Silica Co., 30 N. La Salle St., Chicago, Ill.
Schmid, Fred, 395 Riley Street, Buffalo, N. Y., Clay Salesman, Butler Clay Co.
Stilson, Alden E., U. S. Bureau of Mines, Ceramic Experiment Station, Columbus, O.
Suydam, Albert G., 405 Hobart Bldg., San Francisco, Cal., Pacific Coast representative, Harbison-Walker Refractories Co.
Tombaugh, R. S., Waukegan, Ill., Chief Engineer, Franklyn R. Muller, Inc.
Weaver, Harry F., Evansville, Ind., Secy., and Gen. Mgr., National-Helfrich Potteries Co.
Zandstra, J. J., % Harshaw, Fuller & Goodwin Co., 107 N. Market Street, Chicago Ill., Salesman.

CORPORATION

Cambridge Sanitary Mfg. Co., D. Keith McAfee, Vice-President, Cambridge, Ohio.
The Ceramist, L. R. W. Allison, Editor, 170 Roseville Ave., Trenton, N. J.
Lancaster Iron Works, Inc., Jas. P. Martin, Mgr., Lancaster, Pa.
Pacific Stoneware Co., Thomas S. Mann, 695 Sherlock Ave., N., Portland, Ore.

Membership Worker's Record for May

	Personal	Corporation		Personal	Corporation
L. R. W. Allison		1	W. G. Owen	1	
Paul E. Cox	2		W. F. Rochow	1	
M. A. Gesner	1		Chas. W. Saxe	1	
Ralph E. Hanna	1		Mary G. Sheerer	1	
F. A. Harvey	1		R. R. Shively	1	
H. A. Huisken	1		F. W. Walker, Jr.	1	
Roy A. Horning		1	W. W. Wilkins	3	
Walter M. Hughes	1		Office	8	1
T. S. Mann		1		—	–
R. L. McGean	1			25	4

PITTSBURGH LOCAL SECTION

The Pittsburgh Section of the American Ceramic Society held their regular monthly meeting on Friday evening, May 16, at the Bureau of Mines, Forbes Street, Pittsburgh, Pa. This meeting was one of the most enthusiastic and profitable of any which this Section has held. Following a cafeteria dinner at 7 P.M. the following program was given.

Henry M. Taylor, of the H. C. Fry Co., of Rochester, who is conducting experiments on the dielectric properties of special glass, talked on the development of heat-resisting glass. Examples were shown of high-voltage insulators, sparking plugs and oven ware.

E. H. McClelland, Technician and Librarian of the Technology Department of

Carnegie Library told the members from what source they can follow up this subject at the Library. Mr. McClelland has listed the references on porcelain, among them a number of articles on insulator practice, their design and tests for high voltage currents.

R. E. Arnold, of the Research Department of Westinghouse Electric and Mfg. Company, talked on the development of high-voltage insulators. Mr. Arnold, in conjunction with R. V. Weber of the same company, has had much to do with the development work and tests on insulators and his talk was highly profitable.

The members of the Pittsburgh Section were invited to attend the meeting of the Pittsburgh Section of the American Chemical Society held at Carnegie Lecture Hall on May 22. Harrison E. Howe, Editor of *Industrial and Engineering Chemistry*, talked on "Chemistry in the Nation's Business."

SCHEDULE AND ASSIGNMENTS FOR 1924 SUMMER TRIP

Congregate in Chicago at La Salle Hotel, July 21. Leave 11 P.M. Monday, July 21, on C. M. & St. P. R. R., Union Station.

Spokane, Wash.	July 24. Breakfast, Davenport Hotel. Lunch at Mica. Dinner at Country Club. Local committee will make all arrangements.
Seattle, Wash.	July 25. Arrive 11:45 A.M. Leave Monday, July 28, 11:45 P.M. New Washington Hotel. Banquet in the evening. Local committee will make all arrangements. July 28. Optional trip to Mt. Rainier. Arranged by local Committee.
Portland, Ore.	July 29. Arrive 6:45 A.M. Leave 9:00 P.M. same day. No hotel. Arrangements by local committee.
Lincoln, Cal.	July 31. Arrive 3:15 A.M. Leave 5:20 P.M. same day. No hotel. Arrangements by local committee.
San Francisco, Calif.	July 31. Arrive 10:05 P.M. Leave Sunday, August 3, 11:00 P.M. Palace Hotel. Arrangements by local committee.
Merced and Yosemite	Aug. 4 and 5. Arrive 5:00 A.M. Leave Aug. 6, 8:30 P.M. The hotel and trip arrangements for these three days will be made by the Chicago, Milwaukee & St. Paul Railway Co.
Los Angeles	Aug. 7–13 inclusive. Arrive 7:55 A.M. Hotel Clark. The local committee will make all reservations and all side trip arrangements.
Grand Canyon	Aug. 14. Arrive 8:20 A.M. Leave 7:25 P.M. Arrangements and reservations will be made by the railroad.

Denver, Colo.	Aug. 16. Arrive 12:00 noon. Leave 7:40 P.M. Arrangements made by local committee.
Colorado Springs, Colo.	Aug. 16–17. Arrive 10:10 P.M. Aug. 16 and leave 10:15 P.M. Aug. 17. Antlers' Hotel. Arrangements by local committee

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NOTES AND NEWS

BUREAU OF MINES NOTES

Cyanite

Cyanite, a mineral identical in chemical composition with andalusite and sillimanite, but differing in crystal form, has not yet been exploited to the same extent as andalusite, but has many interesting possibilities, states the Department of the Interior, in Serial 2587, recently issued by the Bureau of Mines. Deposits believed to be of commercial importance are reported at a location about twenty miles southwest of Wheatland, Wyoming, and near Charlotte Court House, Virginia. The latter deposit is being developed at present. The commercial possibilities of cyanite are not yet fully known. Like andalusite it inverts to sillimanite when heated to high temperatures, and possibly may be used to produce sillimanite for refractory purposes.

Preparation of Super-Refractories

An investigation having for its purpose the production, by electric furnace methods, of materials of higher refractoriness than those commonly used in commercial practice is being conducted by the Department of the Interior at the Seattle, Wash., experiment station of the Bureau of Mines. Such refractories have been called super-refractories. The first material to be investigated is sillimanite. Two methods of preparing the material are being studied, namely, (1) From a mixture of clay and aluminum oxide in the form of bauxite, diaspore, or alunite residue; (2) From clay alone by removing the requisite amount of silica and the iron by melting with carbon in the electric furnace. The material thus produced in the electric furnace is then subjected to the methods of testing refractory materials and is fashioned into brick and other shapes and given both refractory and commercial tests.

Encouraging progress has been made in this investigation. It is expected that the work on sillimanite will be completed during the present fiscal year and that another material will be taken up.

Spinel

Spinel is a magnesium aluminate occurring in different colors, chiefly red, blue-green and black. Spinel has been found in many scattered localities in small amounts; deposits of sufficient size to have an economic significance are not known to occur. Spinel has never been used commercially except the rare transparent blue and red varieties which have been used as gems.

While the natural spinel has been of little economic value, it is interesting to note that an artificial spinel, produced by synthesis from its compounds displays very interesting commercial properties. This synthetic spinel is made by the combination

of magnesium oxide from magnesite and aluminum oxide from the mineral alunite, which occurs in large quantities at Marysvale, Utah. During the world war when imports of foreign potash were cut off, these deposits of alunite were exploited for their potash content. The mineral was first roasted, rendering the potash soluble so that it could be extracted by leaching. The aluminum oxide content of the residue after leaching was approximately 95 per cent. The synthesis is accomplished by electrical fusion, the spinel appearing in beautifully crystallized masses. This material when bonded in the form of bricks possesses remarkable refractory properties which have made it valuable for many commercial purposes.

Information regarding spinel and various other little known non-metallic minerals is contained in Serial 2587, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

BUREAU OF STANDARDS NOTES

Test for Alkaline Glassware

Recently a proposed test for the detection of alkaline glassware was carried out by the Chemistry Division of the Bureau. The test consisted in heating the sample in an autoclave at 15 pounds steam pressure for one hour. In the case of the best chemical glassware, water held in the beaker was still neutral to phenolphthalein after the test. Other ware gave results ranging from a very faint alkaline solution to solutions which were decidedly alkaline and were accompanied by considerable insoluble matter. In the last-named cases some of the ware was badly etched.

The Bureau believes that this test is satisfactory for the purpose intended.

"Consistency" as Applied to Sluggishly Flowing Material

The following is an abstract of an article on "Consistency" prepared by W. H. Herschel of the Bureau of Standards at the request of Dr. Jerome Alexander for use in his book "Colloid Chemistry, Theoretical and Applied."

In speaking of a material which will flow sluggishly, it is often said that it has the consistency of rich soup or thick cream. Thus the word consistency has a well-known colloquial meaning, and it may be used as a general term when speaking of soft solids and liquids.

It has been found experimentally when testing what may be called true or viscous liquids, that the rate of flow is proportional to the force which produces it. Other materials may flow quite readily, and yet be soft solids or plastic materials which do not show the constant proportionality above referred to.

It is only recently that it has been realized that many common materials, such as paint and mixtures of clay and water, are plastic and not viscous, and much confusion has resulted in colloidal chemistry from the failure to make this distinction. No method of measuring consistency has proved entirely satisfactory for stiff clays and fats, but it is at least possible to determine which materials are plastic, and to measure the plasticity of many plastic materials which are sufficiently fluid.

In cases of doubt tests should be made at more than one rate of flow, and if the numerical results vary, showing that the material is plastic, the attempt should be abandoned to express the consistency of the material by a single numerical value called "viscosity." Two laboratories, by using standardized apparatus and the same rate of flow, may obtain the same "apparent viscosity" for a plastic material from a single test, but it is important to observe that to identify the consistency of a plastic material it is necessary to make at least two measurements at different rates of flow.

Methods and Materials for Lining Tanks with Tile

An investigation is being carried on for the Associated Tile Manufacturers to determine the proper methods and material for lining tanks with tile. During the past month six more concrete tanks have been made. Nos. 123 to 127, inclusive, have been lined with vitreous tile and the corresponding sets of tile bars for transverse strength tests have been made. The grouting cement was a so-called natural cement. Tank No. 119 of this series has now been filled with photographic fixing solution; tank No. 120 with photographic developer; while Nos. 122 and 123 have been filled with sulphurous acid (saturated solution). The effect of these solutions on the linings of the tanks will be studied.

DEPARTMENT OF COMMERCE NOTES

Fourth Reduction in Vitrified Paving Brick Adopted

After having made a comprehensive survey of demands for various sizes of vitrified paving bricks for 1923, the permanent committee on simplification of varieties and standards in that industry met Friday in the Division of Simplified Practice, Department of Commerce, and voted to adopt the fourth reduction in sizes and types since simplification was begun in 1921.

The committee, comprising Will P. Blair of Philadelphia, of the American Society for Testing Materials; Col. R. K. Compton, of New York City, representing the American Society of Civil Engineers and the American Society for Municipal Improvements; Edward E. Duff, Jr., of Cleveland, Ohio, representing the National Paving Brick Manufacturers' Association; Leon C. Herrick of Columbus, Ohio, representing the American Association of State Highway Officials; E. W. McCullough, of the Fabrication Production Department of the United States Chamber of Commerce; E. J. Mehren, of the McGraw-Hill Co., New York City; O. W. Renkert of Columbus, Ohio, representing the American Ceramic Society and P. St. J. Wilson of the Bureau of Public Roads, Department of Agriculture, found that for 1923 the demand for the six recognized varieties had comprised 80.3% of the total business. The size which was eliminated at today's sessions was found to take up but nine-tenths of 1% of the demand for the same period.

When the paving brick industry first undertook simplification in November, 1921, the 66 sizes then made were cut to 11. At later meetings of the permanent committee on simplification, this number was reduced to seven, and then six, the latter number having stood the test of a year's survey with the results indicated.

This industry was one of the first to seek the coöperation of the Department of Commerce after Secretary of Commerce Hoover initiated the movement for simplification as an aid to American industry. Among the benefits which have been reported through its action are: reductions in cost of production, improved service, and ability to compete more effectively with producers of other types of paving materials.

SOCIETY OF GLASS TECHNOLOGY

The seventh Annual General Meeting of the Society was held in Sheffield on Wednesday, April 16, 1924, the President, Prof. W. E. S. Turner, in the chair. Col. S. C. Halse (Messrs. J. Lumb & Co., Ltd., Castleford) was elected President in succession to Prof. W. E. S. Turner. The other vacancies arising were filled as follows: *Vice-Presidents*, F. G. Clark (Messrs. Beatson, Clark & Co., Ltd., Rotherham), R. L. Frink

(Glass Research Association, London). *Members of Council*, H. A. Bateson, W. R. Dale, J. Moncrieff, W. J. Rees, J. H. Steele, and H. Webb. *Honorary Treasurer*, J. Connolly. *American Treasurer*, Wm. M. Clark. *Honorary Secretary*, S. English. *Auditors*, Ed. Meigh, and Dennis Wood.

The Annual Report and Accounts for 1923 showed that year to have been a happy and successful one. The foreign membership continued to increase, numbering 190 out of 615 at the end of 1923. Of these 109 were resident in the United States. Altogether the Society was connected by membership with no fewer than 17 countries. Prof. Henry Le Chatelier, Paris, was elected an Honorary Member of the Society. A paper entitled "The Physical Properties of Some Alloys Resistant to Heat and Corrosion" was read by J. H. G. Monypenny, and illustrated by lantern slides and specimens. The author dealt with problems which might occur in machinery pertaining to the glass industry, and said there were also certain general engineering uses for material having these special properties, such as the application of the material to various fittings for steam service and hydraulic work.

Dealing first with stainless steel, he outlined the range of properties obtainable, dwelling also on the mechanical and heat resisting properties. Passing on to alloys developed for special properties, the lecturer gave particulars of stainless material in which resistance to mineral acids had been greatly increased, and the tendency for galvanic action in contact with bronze and other copper alloys entirely removed. A short description of some special alloys which had been developed for resisting scaling was given. A sample exposed in a brick kiln for a fortnight, the temperature reaching 1,200 °C revealed a total change in weight of only .04%. The glass industry required alloys suitable for a number of special purposes, in some cases for resisting general corrosion, and in others for resisting the effects of high temperatures. Probably no single alloy would be suitable for all purposes, though for any of those purposes some type of stainless steel would be found useful. For developing any one special property in an exceptional degree, it was generally found necessary to sacrifice other properties to some extent, so that it was advisable for the maker and the user to collaborate.

Mr. W. R. Barclay followed with a paper entitled "Some Properties and Possible Industrial Uses of Alloys Containing Nickel." Illustrating his remarks with lantern slides Mr. Barclay said that he proposed to deal with two alloys, the simple nickel-copper series and the nickel-chromium series, with no other metals added. Referring to the nickel-copper alloys he emphasized their remarkable ductility, combined with considerable toughness and strength, and very considerable resistance to corrosion. A retention of strength at temperatures higher than those at which ordinary non-ferrous metals break down was particularly evident in the nickel-copper alloys containing high nickel. As an illustration of the enormous ductility, he quoted a recent example of material manufactured, in which it had been possible to cold-work a 2 in. bar right down to .02 in. without annealing.

Going on to deal with the nickel-chromium alloys, he pointed out that the two hitherto developed were the 85% nickel, 15% chromium, and the 80% nickel, 20% chromium. They were remarkable materials, bridging the great gulf that had hitherto existed between ferrous and non-ferrous materials, and combining in a high degree the best properties of both. These were the alloys which had made modern developments of electric heating possible. A very important application of them, which the immediate future would see unquestionably, was their use in annealing furnaces where temperatures up to that order were required.

During the morning an exhibition of special steel and non-ferrous alloys, and of tools and plant made from them, was held in the Department of Glass Technology of the University of Sheffield. The following firms exhibited:

Messrs. Brown Bayley's Steel Works, Ltd., Sheffield,
Cronite Foundry Co., Ltd., Tottenham, London,
T. Firth & Sons, Ltd., Sheffield,
Foster Instrument Co., Ltd., Letchworth,
H. Wiggin & Co., Ltd., Birmingham,
T. G. Wolstenholme & Sons, Sheffield.

The President announced that the next meeting would be held in London on May 27th when a joint conference had been arranged with the British Society of Master Glass Painters. They also expected to welcome on that occasion a party of members from France. The Annual Dinner would be held on the evening of May 27th in the Hotel Cecil, London.

A FRENCH MONTHLY REVIEW

A new monthly review was started in November, 1923, entitled "*La Revue Generale des Colloides et de leurs Applications Industrielles.*" Hitherto no French publication has specialized in the study of colloids, the importance of which in industrial technic is constantly increasing. Processes resulting from the theory of colloids may revolutionize certain industries now using empiric and routine methods. The development of colloid chemistry being very recent, most of those engaged in industry will be interested in reading this new review. Original articles will appear each month as well as a narrative containing extracts of all the work that has appeared and French, English, American and German abstracts divided into twenty-four classes.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21–Aug.—1924	Trip to Pacific Coast
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Foundrymen's Assn.	Oct., 1924	
Am. Gas Assn., Inc.	Oct., 1924	
Am. Society for Testing Materials	June 23–27, 1924	Atlantic City
British Assn. for the Advancement of Science	August 6–13, 1924	Toronto, Canada
Chemical Equipment Assn.	Sept., 1924	
Colloid Symposium	June 19–21, 1924	Northwestern Univ., Evanston, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Manufacturing Chemists' Assn.	June, 1924	New York
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Ornamental Glass Mfrs. Assn. of U. S. and Canada	June 24–26, 1924	New York
Natl. Paving Brick Assn.	Dec., 1924	
Refractories Manufacturers Association	June 23–24, 1924.	Atlantic City
Society for Promotion of Engineering Education	July, 1924	Boulder, Colo.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)
Western Glass and Pottery Assn.	June 15, 1924	Pittsburgh, Pa.
Western Society of Engineers	June 4, 1924	Chicago, Ill.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Mary G. Sheerer, H. S. Kirk — Art
R. R. Danielson, H. G. Wolfram — Enamel
G. E. Barton, A. N. Finn — Glass
F. A. Harvey, R. F. Ferguson — Refractories
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R. L. Clare
C. C. Treischel

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EDITORIAL

CERAMIC INSTITUTE

A new proposal is this and yet old in its concepts. It is the natural resultant of many factors. Its origin is not easy to trace. Its ultimate pronouncement was by the ceramic industries through their respective trade associations. Its ultimate conception was by those organized groups which have felt its need most keenly. The vision which brought into clearest focus the idea of a Ceramic Institute was that of the ceramic trade associations.

Behind all organized movements there are contributory and immediate causes. These most often in a given case are very different. Among the contributory causes behind this movement for a Ceramic Institute is the general realization of the value placed by manufacturers on exact fundamental knowledge. The immediate cause is the necessity to cheapen manufacturing processes and the urge to better the product.

There is a large gap between the finding of fundamental science facts and the applying of them in the production of wares. The fundamentals are found only by concentrated effort by individuals with very exact and limited purposes. As a rule the fundamentals are disclosed only by the extravagant expenditure of time and the employment of highly specialized ingenuity.

The fundamental investigator cannot work in the shadow of a utilitarian purpose. His whole vision is concentrated on the finding of a single fact.

The unsurveyed fields in sciences of special interest to ceramists are vast, and competent workers few. These are the reasons why manufacturers have for so long a while had no interest in nor felt any obligations to support pure science research.

One employed in fundamental research eventually seeks and finds related facts. This leads through formulation of general laws to their application. This is the manner in which fundamental science facts find a use and become of industrial value.

No one group of persons has a monopoly on knowledge of fundamental facts. No one has exclusive possession of experiences in science application. Collaboration is essential particularly among those who are making industrial application of scientific facts. This is why a ceramic institute is being brought into existence. Its establishment is almost a fact and no doubt will be a fact before the close of the year of 1924. Meetings to this end are being held.

There are problems which can be solved only by expenditure of comparatively large sums and on a scale which would be impossible except through the collaboration of many. Problems of drying and firing of ceramic ware; the survey of sources of materials and their preparation; methods of "winning" raw materials and the devising of means to reduce hand labor in fabrication are problems common to all clay workers. The fuel problems are common to all ceramic concerns. It is perfectly feasible for all groups of ceramic manufacturers to join in support of these investigations on a scale adequate to bring results more surely and quickly.

If 15 to 50% fuel economy is possible without altering the equipment, every ceramic manufacturer should know how and should share in cost of knowing how. It is idle for one group to suppose that it can buy the exclusive right and benefits of an investigation. "The facts will out." The news soon filters through to every concern which has the ability to learn and to use information.

To all who can profit from an investigation should be given the opportunity to so assist in its financing that the investigation may be more thorough and the results be of greater value not only to ceramic manufacturers generally but to each one in particular.

PAPERS AND DISCUSSIONS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY PLAN FOR INDUSTRIAL COÖPERATION[1]

By C. L. Norton

I was greatly gratified when your Secretary was kind enough to ask me to come and talk to you a little while upon the subject of our industrial coöperation scheme which we have been carrying on for four or five years at the Massachusetts Institute of Technology under the somewhat ponderous title of "Division of Industrial Coöperation and Research." I am particularly pleased to be able to talk with you about it as I think this is the first formal public utterance that we have made in the last four years in regard to the real working of the plan.

I am sorry that there seems to be no way of finding in whose mind was the original conception of this idea, but it certainly is true that to Dr. W. H. Walker, at that time Professor of Industrial Chemistry at the Institute, and now non-resident professor, was due the motive power to drive the thing into actual existence, and to his original ideas in collaboration with the late President MacLaurin the scheme owes its origin.

In a general way we were in the throes of an endowment drive and the scheme had a somewhat erratic beginning in connection with that, but in substance the idea was to secure the coöperation of such industrial companies as were interested in research and to set up a coöperative scheme whereby they would pay us a certain amount of money annually and we in return would do certain things for them.

The initial set-up involved contracts with about 225 companies, varying from some of the very largest industrial concerns to those of small size, including a considerable number of trade associations about which we have so interestingly heard this morning, and lasting in most cases for five years and involving a total amount of about one million and a quarter in payments over the period of five years.

The services which we undertook to render were of three kinds. In the first place we were to do all that we possibly could to determine the location and the qualifications of such personnel as it might seem desirable to add from time to time to the staff of the various contracting companies. That is, if they wanted engineers or scientists for any particular purpose, we were to maintain such index and files, etc., that we should be able to find them when wanted, whether for an occasional service or for regular employment. I think I may say that we have been extraordinarily successful in this personnel branch of our work and its scope has gone far beyond the two or three hundred original contractors and our bureau is re-

[1] Presented at the Atlantic City Meeting, Feb., 1924 (General Session).

ceiving inquiries for men of all sorts of unusual and occasional services as well as for expert and scientific advice and service in matters of prolonged research or permanent employment.

The second term of our agreement was to furnish information from our libraries and files with other collaborating libraries, and such scientific information as we could without prolonged research, and to compile bibliographies, etc., or as Dr. Walker used to say, "to furnish to the contractors on demand any information that anybody on the staff had under his hat." That is, it was not research, it was not long investigation, but as a rule the reply to the occasional question—the search for brief bits of reference, etc.

This reference work has also grown greatly although, of course, you realize that there are a good many other organizations carrying on similar service.

But to the third, and in my opinion, our primary function, was the planning and direct control of research and the study of problems, either small or large, and the digging out of problems by plant visitation, and by consultation work by those who were actually engaged in industrial operations.

That was the plan. That was what we undertook to do. Perhaps it is interesting to look at its present status at the end of four years of trial. Let us see just what happened to the Institute itself in that connection.

As you probably know we have an institution containing from three thousand to four thousand students, running nine months in the year in regular academic fashion with a pretty active series of sessions running throughout the summer, and a staff of some four hundred people devoting their time mainly to the training of young men. Our main business is, has been, and I hope always will be, teaching school. It is to train young men to be scientists and engineers, rather than to aid industry. And with that in mind let us see what happened to the Institute as a result of our coöperative industrial work in the last four years.

Without exception, every contact the plan has had with the Institute has been helpful. The contact of the staff and the contact of the students with outside practical men with very definite problems has been without any question of great help. Further, we have discovered that instead of being a group of fifteen departments, it has become one great group devoted more nearly to the same purpose than it ever was before. This is the first reaction of the Technology Plan.

We have endeavored to carry on all the research work which has come in under the plan with the actual members of the teaching staff. There has been no serious attempt made to add a research unit. What comes to us is in my opinion better handled by the expert scientists and engineers, the men who have attained distinction as teachers and in the capacity

of researchers, rather than to build up a group of young men who might devote their whole time to research. What we are doing as the load increases is to increase the number of teachers and to increase the time which each man may devote to research and development under the coöperative plan and very materially, therefore, increase the total staff.

It has been said that that effort of coöperation is to make our industrial work a sort of by-product of our educational work, and as such it seems to have produced a by-product of unusual value if we may judge from the reaction upon the Institute.

I believe also that the plan is a very definite and forward step in modern education, although perhaps it is of not as much interest to you who are practically concerned with ceramics at the moment, as it is to us whose business it is to teach, but it will ultimately be of some interest, because it is upon the men which institutions like ours turn out that you have to depend more and more as the work of the ceramist and engineer generally becomes more highly specialized.

If you will go back fifty or seventy-five years you will find that all our higher educational institutions taught by book and blackboard and very little else. Along about the time of the Civil War the laboratory method began to be developed and we find a number of institutions beginning to teach physics, chemistry and elementary engineering by the laboratory method. We have gone on for about seventy-five years increasing our specialization but generally conceding that no one can teach applied sciences and technology satisfactorily except by a robust and definite laboratory method.

We have now come to a third stage of development where we must have in the great technical institutions something besides its own laboratories in which these elementary subjects can be taught. It is all very well if we are to teach ceramics for us to maintain chemical laboratories, physical laboratories and laboratories of heat measurement, etc., but in order to know what is going on, if I see this vision aright, we must have somewhere adjacent small ceramic units, kilns which may be operated and controlled, grinders and mixers, and all sorts of things that go into the elementary stages of the art in considerable measure. I believe that our coöperation with an industry, if it only brings to the educational institution more and more such practical work, will enable us much more nearly to meet some of the very wise criticisms which your President made in his opening address. I have run several factories myself, and I agree entirely with his suggestions as to the limits of utility of the extremely recent technical graduates.

The advertising value of our coöperative plan to the Institute has turned out to be very great, although it was quite incidental to the general plan. Wide publicity has been given to the plan and the struggling inventor;

the man with an isolated or somewhat unusual plant, even in a very remote part of the earth, has discovered that a technical institution of good standing has attached to it a sort of point of contact to which he can go, not as a matter of courtesy or privilege but as a matter of regular routine business. He may bring his particular technological and scientific questions or difficulties to the attention of somebody who may be able to help him.

I think you can have no realization of the extent to which this contact has developed in the last three or four years. It has made us an enormous number of friends in remote places which we had never been able to reach, and has been able to make us of service to quite as many people who are not regular contractors under this plan, as those who are.

Leaving our own affairs for a moment let us see what appears to be the reaction of this plan upon the industries generally which have been associated with us. Perhaps you can visualize the thing a little more clearly when I tell you that of the 200 odd contractors there are some of the larger steel companies, companies interested in the manufacture of refractories, a large number of textile people, those making rubber tires, and makers of heavy chemicals, and some of the great testing laboratories whom we expected to be our competitors, but which have proved to be our very best friends, and a large number of small manufacturers whose circumstances are such that they cannot maintain their own research laboratories.

From representatives of this group we have endeavored to find something about the reaction of the plan. There are some people who use it very little; we can get practically no response from them upon matters of research. They use us only as a sort of industrial insurance to be resorted to only in unusual circumstances. Then there is another group that use it only when they get into trouble. They keep a contact with us very much the same as they might carry industrial insurance, so to speak. They have their own research laboratories, and very likely have a staff for the particular service they are interested in, quite as well planned and perhaps more skilful than ours upon any such matters as are likely to come up in their routine business, but occasionally either from new developments or from accidents or from matters of controversy between different members of the trade association, etc., we are called in by them on unusual industrial problems.

With others we have an active daily contact. We are in as close touch with some of these contractors as we would be if we were their individual laboratory at their own plants. For them we are working on incidental problems but preferably carrying out long and fundamental researches.

It has been our effort to avoid the things which clutter up a research laboratory so readily—the routine testing, which is perhaps quite as well done by other people in other places, and to confine ourselves to the longer researches in fundamental matters, as far as possible. Investigations of

some three or four years' duration involving as many as twelve men at a time upon one problem have been the sort of thing which has been brought to us by these types of contact.

A curious process is going on all the time, of course. We are in a way losing our customers. A man comes to us with a particular problem and we tackle it, perhaps with a reasonable degree of success. He either takes our experimenter away from us and puts him to work in his own plant, or asks us, as has been done a very considerable number of times, to equip him with his own laboratory and get the thing going and find the men and set them to work.

I said that we were losing our customers. It did for the moment seem to be the end of the contact in a number of cases, but almost invariably they come back and bring to us the fundamental and unusual problem which the routine research laboratory of their own plant or industry finds difficult to handle or too ponderous for the somewhat limited equipment. You will realize that if we can keep these researches and investigations in our own plant they are not interfered with by the operating man who is so frequently telling the research laboratory that it can or cannot do this thing or that because of the breakdown such and such a unit has been noted or the control study of some other one has been completed. That is, prolonged research is saved from interruptions in our hands whereas if it is in pretty close contact with the plant such interruptions become a constant source of annoyance.

Frequently, we have been able to return to the contractors very much more in a monetary way than either we or they had any reason to expect. Even though their research laboratories are highly developed, we are frequently able to carry on investigations more satisfactorily than they can and the reason is this: We have a group of some three hundred or four hundred men, all specialists in their own lines, all working upon the science or the technology of the moment and because of the necessities of their teaching, perfecting themselves just as rapidly as they can in some line or other. They have a very large modern laboratory equipment, the whole of which is available a considerable portion of the time for things other than the work of teaching. That is, both plant and equipment have given us exceptional opportunity for undertaking problems for which the ordinary plant laboratory would have to equip itself especially. We are doing very profound and prolonged research for some of the largest of the world's research laboratories, they having made transfers to us from time to time, possibly to take them back when they have been developed and enlarged to the point where they have outgrown our province.

Of course, we have exceptional luck at times with investigations of this sort and I think I might be permitted to tell you a story of one of our contractors who was most profoundly unhappy as to the termination of a

development on a machine which absolutely refused to operate properly after a long and weary investigation as to its structure and general behavior. They came to us and asked us if there was anything we could do.

Not knowing the nature of the problem, one of my associates went down to see what it was all about. It was explained to him in considerable haste. It turned out that the trouble was due to a cumulative film which was gradually being deposited upon the surface of some of the working parts and which yielded not at all to some of the extraordinary solvents which were put on over and over again.

After looking at it for a while, this man who is a theoretical chemist of some considerable distinction, asked if they had ever used soap. They said "No." The materials which they had used, it seemed, would do anything that soap would do and a great deal more, so it was absurd to try soap.

He said "Would you mind sending out for ten pounds of powdered soap so that we may try it?" Rather reluctantly it was sent for. The soap worked like magic, and the trouble was ended and the machine worked in a perfectly satisfactory manner.

They wanted to know how he happened to use soap. It so happened that our representative is a real expert upon the subject of soap. He knows much more about soap than most chemists. He said there was no magic and no theoretical chemistry about it, however, but that he got some of the stuff on his hands when he handled the machine and noticed that it readily came off when he washed his hands with soap. Now that in a way was pure luck, but our general technical staff is frequently focusing its attention upon problems quite as definite as this, and a stranger from the outside whose business has been to look broadly at the problem (I have in mind at the moment some of your ceramic problems too) has a perspective which is a great deal better than that of the fellow who is getting down in the noise of the grinding pan or in the muddiness of some other operation and is not able to see the thing quite in the proper dimensions. It is in that way that we have helped many of the big laboratories by furnishing men to take a new and rather fresh general view instead of a highly specialized one.

Perhaps you might be interested in knowing what sort of things are at the moment going on in the laboratory. You will bear in mind that the entire great plant and equipment of ours is our research laboratory, it having been generally agreed after some years of struggle that the whole institution is itself a research laboratory and that the men who teach shall in most instances be the men who do the research. There may be some adjustment of time between the two in different instances, since some men are born teachers and others are born researchers, but the division of the work is the general policy we have been adopting so, if we need to, we can

usually get any man of the entire staff to put upon any problem and can give a reasonable amount of elasticity in his teaching schedule to permit it. I have yet to hear from the students that any one of the men we are using has been neglecting the teaching work.

Now as to the research which will perhaps indicate somewhat the scope of this work. We have gone into a long study of the effect of low dielectric insulation in preventing cable breakdowns. A second investigation which has been going on for some time and which terminated recently in a very satisfactory manner, is the determination of the nature of the caustic brittlement of steel. When you stop to think that a piece of boiler plate ordinarily tough and firm and strong may, under certain conditions of use, become exceedingly brittle, it leads one to think a little bit about the rigidity and permanence of boiler structures subjected to caustic soda, and the investigation of this peculiar and insidious action of caustic solutions upon steel has been carried on by us for one of the contractors for about five years and employs at times four or five men. The results of this investigation are now being printed.

We have researches upon the subject of refractories about which we are unable to say much since they are development work carried on for individual concerns. Some of them have progressed to the point where actual production of the finished material has begun apparently with considerable satisfaction, and promise of commercial success.

We also have another group of men studying the heat transfer in gas pre-heating stoves and similar devices.

We are carrying on an investigation of food values of certain cattle foods.

We are studying problems in compounding rubber, both questions of a mechanical sort and also of substitutes and alterations and accelerators.

It has been possible to get together enough manufacturers upon some of these problems to have a fairly definite group rather than to depend upon isolated support.

We are beginning again a long fundamental search for the causes of corrosion of steel, having been given funds enough to carry on that work which we have been doing more or less in an interrupted fashion since 1897.

We also have a group of men working upon a purely scientific problem—the determination of thermodynamic properties of steam at turbine pressures.

We are studying the thermal conductivity of refractories and insulating materials, and just now finishing an investigation of the thermal conductivity of refractories of very high temperatures, and I think we are in a position at last to get some clear notion of their thermal conductivity right up to the point where they are no longer able to carry loads.

Another investigation is the study of the discoloration of chocolate candies.

All through this list I have avoided, as being, perhaps, of less interest to you, those problems which are problems of what we call *pure* scientific research. I do not know exactly what that is; I have never found anybody who did know exactly, but where a man goes hunting scientifically after something that he believes is there, hoping to find out what it is, we call it pure scientific research. If he goes after something he knows is there but does not know whether he can get it or whether it is of any use, we are inclined to call that research applied to a definite purpose or definite problem.

But with all the research activity the country over, such as Dr. Howe has just described to us in his paper on the activities of trade associations,[1] and also with the activities of the government bureaus and all the universities, you can see that we are doing a great deal of work upon the technical problems, the things that interest us for the moment, but we are doing altogether too little work upon the things which lie back of all the investigation, or fundamental problems which are more often matters of pure physics or chemistry.

As one of the wise men of the research field told me the other day—"If we don't watch out we are going to find ourselves all dressed up and no place to go"—we are going to run out of fundamental information and problems.

You and I and all of the men in this industry have got to begin to study a little more about the fundamental behavior of silicates, the precise determination of what constitutes the reaction that goes on in the fundamental bodies we are working with, whether it is refractories or glazes, or the fifty-seven other things which you know about, and I cannot even name. We shall soon find that we must study the fundamental problems, otherwise industry is going to be pretty abruptly at a standstill in comparison to the progress which it has made in the last ten years in research of this kind.

I give it to you as a thought that I hope you will carry away with you because it is the influence of the practical men associated with industry that has kept this development back. Their unwillingness to attempt the problems of physics, geology, chemistry, etc., as they relate to industry has delayed things quite a little and your hearty coöperation in letting this youngster or that one or perhaps an older man devote his time to some problem in *pure* science is going to be the leaven that perhaps will bring to your industry some great return.

In conclusion, I am asked by our President, Dr. Stratton, formerly, as

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[1] See *Bull. Amer. Ceram Soc.*, **3** [6], 209 (1924)

you know, at the Bureau of Standards in Washington, to state most positively that the work which we have long been contemplating, the establishment of a course in Ceramic Engineering at Technology, has reached the point where we are going to put it in operation. Our quandary has been this: just exactly how to do it. We trust that we may receive suggestions and advice from the members of the SOCIETY.

ADDRESS ON TERRA COTTA[1]

BY WILLIAM H. POWELL

It may be of interest to consider very briefly the relation of the ceramist to the terra cotta business, particularly as to the development of that relation since ceramists were first employed in terra cotta work.

While the ceramist has come to have many duties in the terra cotta plant, primarily he is supposed to be responsible for bodies, slips, glazes, and firing conditions.

The first terra cotta ceramist I knew was an English glaze mixer. He compounded glazes behind closed doors and retained personal possession of the formulae. He produced what was apparently very satisfactory cream glazes as well as a few other colors, such as greens, tans and blues, all burned at about cone 7. Somebody discovered that this cream glaze he was making could be sand-blasted, producing a very beautiful matt surface—which Stanford White, the distinguished architect, once described as having a bone-like texture, more closely resembling elegant marble than anything he had ever seen. So far as I know, this was the beginning of the use of glazed terra cotta in the east.

This mixer had nothing to do with the composition of the body—which appears to have been left in the hands of others—and such clays as were used were selected more on the basis of expediency than for consideration of permanence, although it may be a question if any doubt as to permanency arose in the mind of anyone.

Unfortunately, our friend the mixer was found dead in bed one morning, and he took his recipes with him. His employer had a very hard time of it for awhile. I think that was about the end of one-man knowledge in the terra cotta business.

Shortly after his death the specially trained ceramist began to appear in the industry and the manufacture of glazed terra cotta gradually became quite general.

During the early years in most companies the ceramist had very little to do with the composition of the bodies and nothing very much to say as to the selection of clays. He used what was given to him, and if he ever

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Terra Cotta Division).

had any doubt as to the propriety of using what was given to him, that is, from the standpoint of permanency, he managed to conceal that fact very successfully from those who were in daily contact with him.

One of the very early men conceived the idea of firing both glazed and unglazed terra cotta at cone 2 and some very beautiful effects were produced. Unfortunately, the glaze was apparently immature and crazed badly, and the body, which ought to have been fired around cone 7, of course, was quite different at cone 2 and a great deal of material sold showed very serious disintegration in a few years. Another ceramist I knew of thought it would be a grand idea to stop the crazing of a glaze, which happened to be very popular at that time, by "opening up" the body, as he called it. I think he was right so far as that particular glaze was concerned, and it did correct the difficulty, but the terra cotta went to pieces when used for parapet or free-standing work above the roof line.

Possibly fifteen years ago the ceramist began to be called upon to become responsible for the body but the subject appears to have been attacked first from the standpoint of shrinkage, and it was not until later years that the matter of disintegration, which occurs at times in so-called "free standing" work, particularly with glazed ware, forced itself upon the attention of both manager and ceramist.

This unfortunate defect has undoubtedly created a certain amount of prejudice against terra cotta. It is not my purpose at this time to engage in any discussion as to the possible causes of this destruction. The Bureau of Standards began an investigation of this subject in 1917 with some interruption during the war period, and it has not reached the end yet. It is my hope that the Bureau will eventually make some definite pronouncement on this subject, even if only as to general principles, which will be accepted by all as having back of it the weight of scientific authority.

In the meantime, of course, while we are waiting for the Bureau to say something on the question, there is nothing to interfere with any ambitious ceramist solving the problem for us.

I suppose that you are all familiar with the standard specifications for manufacture, furnishing, and setting of terra cotta, recently adopted by the National Terra Cotta Society after several years of work by a committee in conference with a committee representing the architects.

I should like particularly to invite your attention to the glossary of terms relating to terra cotta which appears in this specification and which represents the official definitions as adopted by the manufacturers. I think it would be useful and very helpful if the ceramists in their literature would adopt this nomenclature in order to secure uniformity.

There are some minor problems that relate to quality that, of course, ought to have attention; for example, the development of a satisfactory patching cement which could be used with equal facility at the factory

or the job when necessary and which would retain its color and strength.

Some years ago, I think two or three, the Terra Cotta Division appointed a committee to take up this subject. I believe that the committee has been unable to get very far. It is an important matter and something that ought to have attention.

Some one ought to develop a solution which would readily clean unglazed terra cotta on which soot has been deposited. Chemists tell me that that is not very easy to accomplish but it would be an important object to effect satisfactorily.

I should like very much, if it were possible, for the Terra Cotta Division of the American Ceramic Society to become attached in some way to the National Terra Cotta Society. I do not mean that it should be detached from the Ceramic Society but I think a way ought to be found to tie more closely the two associations which are supposed to stand specifically for the advancement of the industry of which members of the Terra Cotta Division represent such an important part. As a first step in that direction something might be accomplished if the members of the Terra Cotta Division attended the meetings of the National Terra Cotta Society. If it did nothing else, it might add a little more dignity to the meetings of the National Society.

In an industry like ours, which is half artistic and half commercial and where the operations are substantially all hand processes, the greatest care must always be taken to produce quality. Eternal vigilance is the price of safety. In a business like the terra cotta business there never should be any let down in quality. Price to the consumer rather than the welfare of the industry is an erroneous criterion. We ought to have a decided advantage over natural products because terra cotta permits of complete control in manufacture, while stone must be used as it comes from the quarry.

To my mind, of all the possible qualities of terra cotta which may be developed, the one of permanence transcends that of all others. The colors, textures, or kinds of ceramic finish are in a sense factors of minor importance which are comparatively easy to work out but which are of no use whatsoever unless permanence of body can be guaranteed. We must produce a terra cotta which, whether glazed or unglazed, shall be permanent and indestructible under any and all climatic conditions in any section of this country and with no limitations as to its use so far as permanence is concerned in practically any form of architectural decoration.

350 Madison Ave.
New York City

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire clay to spalling?

2. What difference is there between the properties of a soft mud machine made and a hand made brick?

3. Can an iron-free clay brick be made for blast furnace service?

4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?

5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?

6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand made fire brick?

7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?

8. What is the reason for the more rapid failure, at a lower temperature, of fire brick subjected to reducing atmosphere, than will obtain with the same brick under oxidizing conditions?

9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

Note: It has been suggested by some of the Question Box readers that the matter of grog sizes and content in brick mixtures should receive some attention by this Department. Undoubtedly considerable interest in the effect of various grog sizes and grog contents, on brick service, exists.

It will be noted in the previous discussion on the effect of coarse grinding that no definite behavior can be ascribed to various grain sizes with clays in general. In specific instances the behavior is known to some extent.

The chemical composition and the physical characteristics of the clays employed dictate the grinding treatment and grog content and the problem is almost entirely local.

Inasmuch as there is an outspoken request for detailed information on this subject a call is issued herewith for questions and discussions on this subject. State questions carefully. Confine them to specific clays. Contribute a short discussion of each question if possible, submitting screen analyses, spalling tests and service characteristics. Further discussion will be solicited privately by the Editor.

The compilation of such detailed data will be of considerable value. Loose discussion of carelessly worded questions dealing only in generalities does not meet the purpose of this Department. Any such material submitted will be dealt with Editorial license.

Additional questions on manufacturing and service problems of all classes of refractories are solicited. State questions clearly, make them specific and accompany each one submitted with a short discussion if possible.

If you have any information on any of the questions which have been discussed or those listed for later treatment send it at once to the Question Box Editor c/o The General Secretary, Lord Hall, O. S. U., Columbus, Ohio.

Laboratory Control and Refinement of Process

In the May number the problem of laboratory control[1] was discussed from several angles. Since the publication date there has come to the Editor's attention a novel arrangement which will aid materially in securing uniform mixtures of several batch ingredients and may also assist in the tempering of these mixtures. The description and cuts shown here were originally sent out to some of the customers of Sandvik Steel, Inc., announcing the development of the apparatus, a steel belt being used as the conveying medium. The use of this piece of equipment in connection with present layouts might solve the problem of

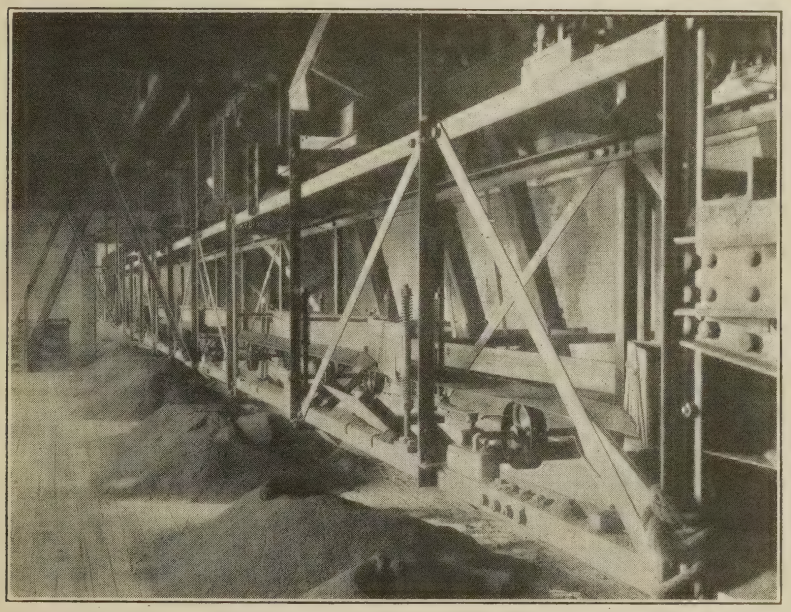

Fig. 1.

uniform mixtures more easily than any of the methods now in prospect. We print here the material furnished at special request together with an extract from a letter.

It appears that installations now in use are serving dry press machines but there is no reason why the feed could not be diverted to one or more pug mills after the thorough mixing had been accomplished.

Mixing and Distributing Belt Conveyor

An interesting piece of equipment for brick plants—a mixing and distributing belt conveyor—has been developed and was installed in several plants in England last year.

[1] *Bull. Amer. Ceram. Soc.*, **3** [5], 162–68(1924).

Fig. 1 shows the general arrangement. A flexible steel belt is used as conveying medium and material is handled on both runs. The screened material is delivered from several bins onto the upper run in layers one above the other. Immediately after the last feeding point there is arranged a series of plows which turn the material over and over. Simultaneously the mixture is sprayed with water by compressed air operated atomizers. It undergoes a final mixing on being plowed off the upper run of the belt and falling down a chute onto the lower run, which thus carries a thoroughly mixed material. The amount required

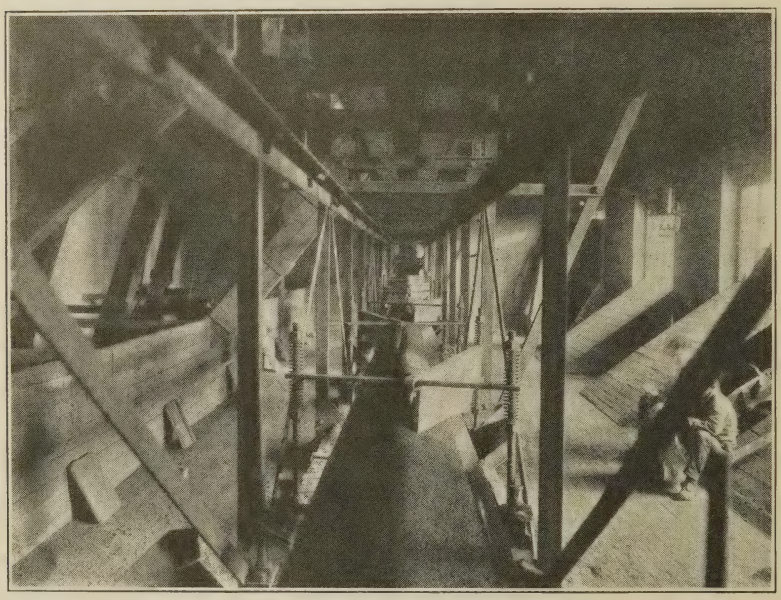

Fig. 2.

by each press is plowed off at the proper place by means of an adjustable plow, Fig. 2.

This mixer-conveyor thus performs a three-fold duty, conveying, mixing and dampening, and its location is immediately in front of the presses, the idea being to supply all the presses with a perfectly uniform material, regardless of the irregularities in each separate bin. The result of this mixing is a much improved product, practically consistent in size, shape and color. Pressure on the presses is less and uniform throughout the year, consequently power consumption and upkeep are much reduced. This conveyor also requires much less power and maintenance than several conveyors previously used for the same purpose.

It further serves the purpose of inter-connecting the machines, making the presses independent of the failure of one or more grinders, as long as the remaining grinders in the battery have sufficient total capacity to supply all the presses.

It is recognized that the steel belt is the only conveying medium that will satisfactorily accomplish all these duties and resist the considerable amount of plowing required.

Units of this kind are in operation in a number of plants abroad and are reported to be giving unprecedented satisfaction. In fact this application, as described in attached writeup, is considered a most important step forward in the manufacture of brick. The London Brick Co. are using quite a number of this type of conveyor throughout their plants. The first unit has been in operation for over a year and it is reported that maintenance expense during that time has been nil except for occasional lubrication.

Question

What specification limits should be considered reasonable on 9-inch fire brick? On special shape brick?

Discussion

Nine-inch Series Allow one-sixteenth inch over or under the standard thickness dimension of two and one-half inches. This means that ten brick piled up may vary between twenty-four and three-eighths minimum and twenty-five and five-eighths maximum.

In length each brick may vary three-sixteenths of an inch over or under the standard dimension.

In width each brick may vary one-eighth of an inch over or under the standard dimension.

Shape Brick Unless special limits of tolerance are shown on the drawing, no dimension should vary more than one-eighth of an inch over or under that shown, excepting that brick having a dimension exceeding six inches may have a variation in proportion to one-fourth of an inch per foot.

The dimension and face which should be most perfect may be so labeled on the drawing.—E. N. McGee, Semet-Solvay Company, Syracuse, N. Y.

The matter of variation in fire brick sizes presents a distinct problem to the designer and builder of furnaces. Allowance must be made in the design of each type of installation and experience must enter into the computation of the amount. The discussion above shows the experience of one designer, and while it applies in some measure to other problems, it cannot be taken as having a universal application. The American Society for Testing Materials adopted early this year a set of tolerance

specifications which are now practically obsolete on account of at least two manufacturers having placed fire brick on the market which do not vary measurably in any one dimension. One of these manufacturers produces a brick which is understood to have as little variation in thickness as one-ninety-sixth of an inch in two and one-half inches, or less than one-sixteenth inch per foot.

The matter of variable dimension is perhaps of slightly less importance than shape, a true surface and square corners being necessary to insure good brick laying. Warpage is common in all fire clay goods made by any process other than the dry press method. This warpage, while slight in standard sizes, is of some consequence in the case of special shapes and tile. The fault lies in the methods of handling, careless workmen and some of it is traceable to unequal distribution of moisture and erratic drying methods, while a portion is the natural result of poor setting or inadequate kiln furniture. Every manufacturer seems to be studying these problems more or less with respect to his particular needs and it is safe to say that uniformity of size and shape will soon be the rule and not the exception as now.

Question

What difference is there between the properties of a soft mud machine made and hand made fire brick?

Discussion

As a rule I think there is not a great deal of difference between brick made in these two ways.

However, as the brick are usually made we have found that, other things being equal, the soft mud machine 9-inch brick, weighing approximately seven pounds, will be three to four ounces lighter in weight than a hand molded repressed brick. A hand repressed brick must be stiff enough when it is repressed to be handled with paddles, whereas a soft mud machine brick could not be so handled.

Therefore, the soft mud machine brick is a little more open in structure than the hand repressed brick, and we have found that it behaves slightly better in the spalling test.

The hand made repressed brick generally presents slightly smoother faces and sharper edges because it is pressed in a steel box, where the other brick is made in a wooden mold. However, because these brick are handled when pressed and still a little soft, and because of the methods used in piling or placing them for drying they do not seem to lay up any better than the soft mud machine made brick, which is not touched by hand until set in the kiln.—S. M. Kier, Pres., The Kier Fire Brick Company, Pittsburgh, Pa.

Without doubt the only difference in the material from which the two types of brick mentioned above are made is the moisture content. The difference in spalling behavior may indicate one means of improving the behavior of certain other brick when coarse grinding is not desirable or effective.

A study of the permeability and of the resistance to slag penetration and erosion of the two types of brick made from the same material would be of interest. Anyone having information on the subject is requested to forward the same to this department.

ACTIVITIES OF THE SOCIETY

NEW MEMBERS RECEIVED DURING MAY 15 TO JUNE 15

PERSONAL

Brandow, Glen A., 69 W. Gibson St., Canandaigua, N. Y., Lisk Mfg. Co.

Brooke, Frederick H., Oughtibridge, Sheffield, England, Managing Director, Oughtibridge Silica Fire Brick Co., Ltd.

Caldwell, John A., Box 1, Frostburg, Md., President, Savage Mountain Fire Brick Co.

Connors, Frank J., J. H. Gautier Co., Jersey City, N. J., Sales and Research.

Daeves, Karl, Phoenix A.-G., Hauptverwaltung, Düsseldorf, Germany, Director of Research.

Decker, Lewis T., 816 Carteret Ave., Trenton, N. J., Assistant General Manager, Independent Brick Co.

Forbes, George A., 615 Clyde St., Pittsburgh, Pa., Sales Agent, General Refractories Co.

Gill, Francis D., Gill Glass Co., Philadelphia, Pa., President.

Goddard, Harry E., Route 1, Box 627A, Richmond, Calif., Chemist, Pacific Sanitary Mfg. Co.

Haupt, C. H., Standard Oil Co., General Engineering Dept., Elizabeth, N. J.

Lalor, Morgan D., 811 S. Union Ave., Los Angeles, Calif., Mechanical Engineer, Los Angeles Pressed Brick Co.

Lamb, Roland H., 305 N. Holiday St., North East, Md., Mechanical Engineer.

Robinson, George R., Hocking Valley Brick Co., Nelsonville, Ohio, Assistant to Manager.

Sheehan, P. J., E. Park Ave., Niles, Ohio, Vice-President and General Manager, Niles Fire Brick Co.

Taylerson, Ewart S., 1410 Frick Bldg., Pittsburgh, Pa., Engineer of Tests, American Sheet and Tin Plate Co.

Thompson, Henry M., Room 516–9, S. Clinton St., Chicago, Ill., President, H. M. Thompson Co.

Weinfurtner, E. M., Ashland, Ky., Treasurer, Ashland Fire Brick Co.

Wykstra, Gerritt E., Michigan Porcelain Tile Works, Ionia, Mich., Superintendent.

CORPORATIONS[1]

J. A. Bauer Pottery Co., 415 West Ave. 33, Los Angeles, Calif., W. E. Bockman, President.

The Owens Bottle Co., 1401 Nicholas Bldg., Toledo, Ohio, S. S. Cochrane, General Factories Manager.

MEMBERSHIP WORKERS RECORD

	Personal	Corporation		Personal	Corporation
Abel C. Cameron	1		H. H. Sortwell	1	
C. E. Fulton	1		E. Ward Tillotson	1	
J. H. Gautier & Co.	1		H. B. Tyler	1	
J. Holland	1		Thomas C. Walker, Jr.	1	
W. G. Owen	2		A. S. Zopfi	1	
W. A. Potter	1		Office	5	1
John Sawyer		1		—	–
R. R. Shively	1		Total	18	2

[1] NOTE: *Bull. Ceram. Soc.*, **3** [6], 238, The Ceramist Corporation address is 17 Roseville Ave., Newark, N. J., not Trenton, N. J.

Our Membership Record for June

Holding in the line. Penalty, more work. Eighteen persons, 2 corporations and 1 renewal is the gross increase for June. Thirteen resignations by persons who are no longer in ceramics makes the net increase only 6 persons and 2 corporations.

This is the worst record yet. Are we down-hearted? No!

Are the members going to push stout-heartedly on until all will be participating in this self-educational enterprise? Yes!

How do we know? Knowledge is the foundation stone of industrial advancement.

The 1924 Monthly Gross Acquisitions

	Personal	Corporations	Total
January	31	6	37
February	40	8	48
March	29	0	29
April	35	3	38
May	25	4	29
June	18	2	20
	178	23	201
The gross acquisitions from January to June were	265	33	298

The Net Roster

	Personal	Corporations	Total
Net Roster May 14	1831	291	2122
Resigned	13		13
	1818	291	2109
Renewal		1	1
New Members	18	2	20
Net Roster June 14, 1924	1836	294	2130
Net Roster June 14, 1923	1792	238	2030
Net Gain since June, 1923	44	56	100

CHANGES OF ADDRESS

The following members of the SOCIETY have requested that their mailing address be changed to the addresses here given.

A. R. Anderson, Mayfield, Ky.
Yngve R. Anderson, Dominion Fire Brick and Clay Products Co., Ltd., Moose Jaw, Canada
E. E. Ayars, Box 103, Coconut Grove, Florida
William G. Bergman, Toledo Engineering Co., Box 6, Sta. G, Toledo, Ohio
Edward Burkhalter, 80 Thirteenth Ave., Columbus, Ohio
M. W. Butler, 1775 Cliffview Rd., Cleveland, Ohio
B. F. Cake, Los Angeles Pressed Brick Co., Frost Bldg., Los Angeles, Calif.
Arthur D. Camp, Box 904, Niagara Falls, N. Y.
W. W. Coates, Jr., Carrs Station, Ga.

S. F. Cox, Diamond Power Specialty Corp., Oakland and Caniff Sts., Detroit, Mich.
R. S. Finney, North American Clay Co., President, 303 W. 80th St., New York, N. Y.
L. J. Frost, Vitreous Steel Products Co., Nappanee, Ind.
Hugh S. Gallagher, 307 Wabash Bldg., Pittsburgh, Pa.
R. F. Grady, Jr., 5811 Manchester Ave., St. Louis, Mo.
John R. Green, 1615 Sherwin Ave., Chicago, Ill.
Walter McK. Hughes, 334 Putnam Ave., Zanesville, Ohio
Otis L. Jones, Illinois Clay Products Co., Barber Bldg., Joliet, Ill.
R. B. Keeler, c/o California Clay Products Co., South Gate, Calif.
Walter A. Koehler, 1611 Chadbourne Ave., Madison, Wis.
F. M. Koenig, Washington St., Carpentersville, Ill.
P. William Lee, 217 W. 15th St., Chicago Heights, Ill.
W. M. Legnard, c/o Interstate Clay Products Co., 160 N. LaSalle St., Chicago, Ill.
E. H. Lintz, 1117 McKinley Pkwy., Lackawanna, N. Y.
Charles Laird, 102 Lake St., Ashtabula, Ohio
C. F. Miller, University of Washington, Law School, Seattle, Wash.
J. A. Nagle, Brunt Porcelain Co., Chaseland, Columbus, Ohio
Clifford H. Parmelee, R. F. D. 1, Warners, N. Y.
J. G. Phillips, 515 Cottage Ave., Piqua, Ohio
E. E. Pressler, 311 Essex St., San Antonio, Texas
Lemuel V. Reese, Erie City Iron Works, Erie, Pa.
H. P. Reinecker, Lynwood, Los Angeles, Calif.
Wallace C. Riddell, 306 New Call Bldg., San Francisco, Calif.
Samuel Rusoff, 231 Hudson St., Tiffin, Ohio
N. L. Schneider, 2004 Union Trust Bldg., Cleveland, Ohio
W. J. Scott, 324 N. Waller Ave., Chicago, Ill.
L. I. Shaw, Western Electric Co., Hawthorne Station, Chicago, Ill.
Charles A. Smith, 1150 Oak St., Columbus, Ohio
Charles H. Stone, Jr., Box 274, Rome, Ga.
Paul Teetor, 911 Edgewood Ave., Trenton, N. J.
Erwin F. Theobald, General Delivery, Bessemer, Pa.
Leo Thurlimann, 341 S. Springfield Ave., Chicago, Ill.
Martha Q. Westfeldt, 633 Royal St., New Orleans, La.

EASTERN SECTION MEETING

The Summer Meeting of the Eastern Section of the American Ceramic Society and New Jersey Clayworkers Association was held at the Trenton Country Club, Trenton, N. J.,on June 20, 1924. The meetings were presided over by the President of the Association Charles F. Crane. At the morning session Ross C. Purdy, General Secretary of the American Ceramic Society of Columbus, Ohio, gave an address on "A Ceramic Institute." At the afternoon session the following addresses were given: "Proposed Investigation by the Bureau of Standards in the Whitewares Field" by R. F. Geller, of the Bureau of Standards, Washington, D. C.; "Fundamentals Underlying Everyday Drying in the Ceramics Industry" by A. E. Stacy, Jr., Research Engineer, Carrier Engineering Corp., Newark, N. J.; and "Practical Aspects of the Casting of Heavy Pottery Products" by C. C. Treischel, R. T. Vanderbilt Co., New York City. Members of the party engaged in a golf tournament. An interesting business session preceded the addresses and the entire meeting was marked for enthusiasm.

WASHINGTON-BALTIMORE SECTION[1]

The third meeting of the Washington-Baltimore Section of the American Ceramic Society was held at the Garden Tea House, Washington, on June 7th at 7 p. m. The meeting opened with the usual informal dinner. Twenty-seven members were present. A. N. Finn, of the Bureau of Standards, was elected vice-chairman in place of Mr. Danielson, who has left the district. C. B. McComas, of the Carr-Lowrey Glass Co., was elected as a member of the Nominating Committee from this Section.

R. F. Geller, of the Bureau of Standards, made a talk on his recent trip to several refractory plants of Missouri and Colorado and described in an interesting manner the clay deposits and methods of manufacture.

P. K. Klaesuis, of the Porcelain Enamel & Manufacturing Co., gave a paper on ground coat practice, the second in a series of papers on enameling methods.

Edgar Worsham read a translation of a short German paper which contained suggestions on reducing costs in the enameling industry. While the attendance was smaller than usual, the meeting was enthusiastic and discussion of the papers was general.

NOTES AND NEWS

RESEARCH AT ILLINOIS

Six of the largest gas and electric concerns in Illinois are coöperating to spend $25,000 annually for two years in research at the University of Illinois.

The companies interested in this project are: Commonwealth Edison Company; the Peoples Gas Light and Coke Co., Public Service Company of Northern Illinois; Middle West Utilities Company; Chicago Rapid Transit Company; and the Chicago North Shore and Milwaukee Railroad Company.

The research to be conducted will relate to the following problems:

Electrical porcelain	$6500.00
Refractories	$6000.00
	$12500.00
Fatigue of structural parts	$7500.00
Boiler feed water treatment	$5000.00
	$12500.00

The investigation of research on refractories and porcelain will be conducted in the Department of Ceramic Engineering under the direction of Professor C. W. Parmelee.

W. L. Abbott, chief engineer of the Commonwealth Edison Co., and formerly president of the Board of Trustees of the University is temporary head of a Utilities Research Committee appointed to organize the work.

The agreement may be extended for an additional period later.

LIST OF STATE GEOLOGISTS[2]

We are frequently asked for the names and addresses of State Geologists. The following were obtained from Dr. W. A. Nelson, Sec. Association of State Geologists.

Alabama Geol. Surv. of Ala., Dr. E. A. Smith, State Geologist, University, Ala.
Arizona Ariz. Bureau of Mines, Mr. G. M. Butler, State Geologist, Tucson, Ariz.

[1] Recd. June 12, 1924.
[2] Corrected list, June 1, 1924.

Arkansas	Geol. Surv. Ark., Mr. J. C. Branner, State Geol., Fayetteville, Ark.
California	Cal. State Mining Bureau, Mr. F. McN. Hamilton, State Mineralogist, San Francisco, Calif.
Colorado	Colo. State Geological Survey, Dr. R. D. George, State Geologist, Boulder, Colo.
Connecticut	State Geological Survey and Dept. of Natural History, H. H. Robinson, Supt., New Haven, Conn.
Florida	Fla. State Geological Survey, Dr. Herman Gunter, State Geologist, Tallahassee, Fla.
Georgia	Geol. Surv. of Ga., Dr. S. W. McCallie, State Geol., Atlanta, Ga.
Illinois	State Geological Survey, Mr. M. M. Leighton, Chief, Urbana, Ill.
Indiana	Dept. of Geology and Natural Resources, Dr. W. N. Logan, State Geologist, Indianapolis, Ind.
Iowa	Iowa Geol. Surv. of, Dr. G. F. Kay, State Geol., Iowa City, Iowa.
Idaho	Dept. of Geol., Dr. F. B. Laney, State Geol., Moscow, Idaho.
Kansas	State Geol. Surv., Dr. Raymond C. Moore, State Geol., Lawrence, Kans.
Kentucky	Ky. Geol. Surv., Mr. W. R. Jillson, State Geol., Frankfort, Ky.
Louisiana	La. Soil and Geol. Surv., La. State University, Baton Rouge, La.
Maine	State Utilities Commission, Mr. F. F. Burr, Livermore, Me.
Maryland	State Geol. Surv., Dr. E. B. Matthews, State Geol., Baltimore, Md.
Michigan	Mich. Geol. and Biol. Surv., Mr. R. A. Smith, Director, Lansing, Mich.
Minnesota	State Geol., Dr. W. H. Emmones, Univ. of Minn., Minneapolis, Minn.
Mississippi	Geologic Economic and Topographic Survey of Miss., E. N. Lowe, Director, Jackson, Miss.
Missouri	Bureau of Geology and Mines, Mr. H. A. Buehler, Director, Rolla, Mo.
Montana	State Bureau of Mines, J. P. Rowe, State Geologist, Butte, Mont.
Nebraska	Nebr. Geol. Surv., Prof. E. H. Barbour, State Geologist, Lincoln, Nebr.
New Jersey	Dept. of Conservation and Development, Dr. H. B. Kummel, State Geologist, Trenton, N. J.
New York	Science Div. (Geological Survey), Dr. John M. Clarke, State Geologist, State Museum, Albany, N. Y.
North Carolina	N. C. Geol. and Econ. Surv., Chapel Hill, N. C. NOTE: This surv. was abolished by the last general assembly, effective Jan., 1925.
North Dakota	N. Dak. Geol. Surv., Prof. A. C. Lenord, State Geol., Grand Forks, N.D.
New Mexico	R. W. Ellis, State Geologist, Albuquerque, New Mex.
Ohio	Geological Survey of Ohio, Prof. Jno. A. Bownocker, State Geologist, Columbus, Ohio.
Oklahoma	Survey abolished.
Oregon	Oregon Bureau of Mines and Geology, Mr. H. M. Parks, Director, 417 Oregon Bldg., Portland, Ore.
Pennsylvania	Topographical and Geological Survey Commission, Dr. Geo. H. Ashley, State Geologist, Harrisburg, Pa.
Rhode Island	Natural Resources Survey of R. I., Mr. Chas. W. Brown, Superintendent, Providence, R. I.
South Carolina	Prof. Stephen Taber, State Geologist, Columbia.
South Dakota	Geological Survey of S. Dak., Mr. Freeman Ward, State Geologist, Vermillion, S. Dak.
Tennessee	Tenn. Geol. Surv., Mr. Wilbur A. Nelson, State Geol., Nashville, Tenn.
Texas	Bureau of Economic Geology, Dr. J. A. Udden, Director, Austin, Texas.
Utah	Mr. Wm. Peterson, State Geologist, Agricultural College of Utah, Logan, Utah.

Vermont	Geological Survey of Vermont, Dr. Geo. H. Perkins, State Geologist, Burlington, Vermont.
Virginia	State Geological Survey of Virginia, Dr. Thomas L. Watson, Director, Charlottesville, Va.
Washington	State Geological Survey of the State of Washington, Mr. S. Shedd, State Geologist, College Station, Pullman, Wash.
West Virginia	W. Va. Geological and Economic Survey, Dr. I. C. White, State Geologist, Morgantown, West Va.
Wisconsin	Wisconsin Geological Survey, Mr. W. O. Hotchkiss, State Geologist, Madison, Wis.
Wyoming	Mr. G. B. Morgan, State Geologist, Cheyenne, Wyoming.

UNIVERSITY GRADUATE FELLOWSHIPS

Graduate fellowships in mining, metallurgical and chemical research are offered by various institutions of learning, in coöperation with the Bureau of Mines, Department of the Interior. The purpose of these fellowships is to undertake the solution of various problems being studied by the Bureau of Mines that are of especial importance to the regions in which the institutions of learning are located. They afford excellent opportunities for qualified young men to become experts in the fields of mining, metallurgy and chemical technology, and to prepare themselves for highly technical work in these fields.

For the college year 1924-1925, the following institutions offer such fellowships:

University of Alabama, Tuscaloosa, Ala.
University of Arizona, Tucson, Ariz.
Carnegie Institute of Technology, Pittsburgh, Pa.
University of Missouri, Rolla, Mo.
Ohio State University, Columbus, Ohio
University of Utah, Salt Lake City, Utah
University of Washington, Seattle, Wash.
University of Idaho, Moscow, Idaho.

The value of the fellowships offered by the University of Alabama is $540.00 per annum. At this institution five fellows were appointed for the college year 1923-24, whose investigative work related to the washing of Alabama coals and the beneficiation of low-grade brown, red hematite and gray specular hematite iron ores.

The University of Arizona offers fellowships of a value of $750.00 per annum. Previous work performed by fellows at this university has related to the selective flotation of copper sulphide minerals and the leaching of heavy sulphide cupriferous ores with ferric salts.

The value of the Carnegie Institute of Technology scholarships is $750.00 per annum. In 1923-24, six fellows at this institution studied the use of gas masks in fighting mine fires; efficiency in blasting coal; friction losses in mine cars; corrosion of metals and alloys in acid mine waters; time-rate of combustion of coal dust particles; and the correlation of coal beds of western Pennsylvania and eastern Ohio. For the coming year there will be either six or seven fellowships in coal mining, four of them supported by Carnegie Institute of Technology and two or three by the industry. One to be supported by the Hillman Coal & Coke Company is definitely agreed upon. A second fellowship on friction losses and mine car axles and bearings is to be supported by the manufacturers. A third, on the efficiency of blasting coal, will probably be supported by one of the coal companies.

The value of the fellowships of the School of Mines and Metallurgy of the University of Missouri is $800.00 per annum. In 1923-24 two fellows studied the influence of time, temperature and rate of cooling on mine drill steel, and the effect of various factors on the rate of reduction of zinc compounds by carbon.

The Ohio State University fellowships are valued at $750.00. Fellows at this institution have studied such problems as the use of dolomite for refractories and the electrical conductivity of refractories at high temperatures.

The University of Utah fellowships are valued at $720.00 per annum. In 1923-24 five fellows studied the utilization of Utah hydrocarbons; the hydrometallurgy of zinc; ore dressing problems; and the geology and microscopic examination of complex zinc ores.

The value of the University of Washington fellowship is $810.00 per annum. In 1923-24 five fellows at this institution studied the washing of Washington coals; the preparation of super-refractory products and electrometallurgical problems.

The University of Idaho fellowships are valued at $750.00. In 1923-24 the fellows at this institution studied the treatment of various gold-silver ores.

Detailed information in regard to these fellowships may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C., or from the various institutions named.

BUREAU OF MINES NOTES

Georgia Clays for Rubber Fillers

A study of Georgia white clays with respect to their use as fillers in rubber has been completed by the Department of the Interior technologists on the staff of the Bureau of Mines. The purpose of this work, which was performed in coöperation with the Central of Georgia Railway, was to determine which Georgia clays, when properly prepared, are suitable for use in rubber compounding. Samples were collected from various deposits not now used in preparing rubber filler, as well as clay from those mines which are already producing clay for use in fillers. The samples were washed, dried, pulverized and purified in accordance with good commercial practices, and their chemical and physical properties carefully determined. Tests were then made in commercial plants on selected samples. It was found that some of the clays were suitable for use in making high grade rubber. There was, of course, a considerable range in the properties of the different clays tested. It was shown that fineness of grain is one of the most important physical factors in the reinforcing power of the clay. Further work along this line is desirable.

Mineral Grinding Studies

The grinding of flint for ceramic uses is a quite difficult problem on account of its great toughness and resistance to abrasion. Heating the material before grinding makes the process easier. Interior Department investigators at the New Brunswick, N. J. experiment station of the Bureau of Mines will make experiments to test the efficacy of combined heating and quenching. The method may be extended to other minerals.

Sillimanite

Only small, scattered deposits of sillimanite are known in the United States, no commercial sized deposits being located to date, according to W. M. Myers, assistant technologist, Department of the Interior, in Serial 2587 of the Bureau of Mines. A large deposit is reported to occur in India. Very superior refractories are said to be made almost exclusively of synthetic sillimanite. Whether natural cyanite or sillimanite can be substituted can only be determined by careful research. As the value of the andalusite group of minerals becomes better known and as more people become acquainted with their appearance so that they can

recognize them in the field, it is possible that other deposits may be found possessing sufficient tonnage and favorably located with regard to transportation to make their development possible.

Oxidation of Ceramic Wares during Firing

In connection with an investigation of the oxidation of ceramic wares during firing, being conducted by the Department of the Interior at the Columbus, Ohio, experiment station of the Bureau of Mines, a study of the effect of varying the rate of gas flow and of heating on the decomposition of pyrite in clay has been made. This work will be extended to include a number of typical fine grained commercial clays. It is felt that this work may have a very practical bearing on the method of firing ceramic kilns.

Expansion of Flint Fire Clay during Heat Treatment

The purpose of an investigation being made by the Department of the Interior technologists at the Columbus, Ohio experiment station of the Bureau of Mines is to ascertain as definitely as possible what causes flint fire clay to change its volume during the process of heat treatment. Results to date indicate that the Missouri flint clays have a much greater shrinkage than the Pennsylvania flint clays. A comparison of the burley flint and smooth flint clays taken from the same locations shows that the smooth flint clays shrink to a greater degree. The difference in shrinkage is attributed to the diaspore present in the burley clays, which acts like a grog.

Lime from Small Stone

Profitable disposal of limestone too small for making lime in the shaft kiln is one of the most urgent problems in the lime industry, states W. M. Myers, assistant mineral technologist, Department of the Interior, in Serial 2596, recently issued by the Bureau of Mines. Reports received by the Bureau of Mines from 31 quarries show that the proportion of small stone varies from 2 to 40 per cent, averaging 18 per cent of gross production. Modern methods of heavy blasting, and the use of crushers in large quarries tend to increase the proportion of small stone above that produced in early days when light blasting and hand sledging were almost universally used. There is also a growing movement toward underground operation of lime deposits, a method which in general produces a greater proportion of fines than is encountered in open-pit work. Thus the small stone problem is of growing importance, and demands the attention of every progressive lime producer. The general problem of the production of lime from small stone is considered by Mr. Myers in Serial 2596, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

BUREAU OF STANDARDS

Light Waves Used to Measure Thermal Expansion

The rate at which porcelain and other ceramic materials expand with increase in temperature is measured at the Bureau of Standards by means of light waves, using a method recently developed there. Small pins of the material from 0.02 to 0.4 inch long are placed between two interferometer plates of fused quartz and are heated in an electric furnace. Interference fringes are formed by the light reflected from the interferometer plates, and pass the reference marks on the plates as the sample expands with heating. A change of length of a millionth of an inch can be detected by this method, the Bureau states.

Interference fringes are formed where light reflected from one surface joins light reflected from another. If the two waves when they reach the eye are opposite in

phase they neutralize each other and produce darkness. If they are the same in phase they reinforce. The number of fringes formed is therefore proportional to the number of wave lengths of light in the distance between the plates. Light waves vary in length from red waves, 0.000028 inch long, to violet waves of little more than half that length. Light of one color is used in the tests.

Using this method the Bureau has made measurements of the thermal expansion of several samples of glaze, terra cotta, tile, porcelain, and clay between the temperatures of 20° and 2000°C. Some of the samples were specially prepared while others were taken from finished products, and some of the latter were from products that had failed in service.

The results of measurements showed that the thermal expansivities of ceramic materials may differ greatly. When two or more are combined, therefore, failure of the ware may be caused by this difference. Glaze applied to tile, for example, may crack or scale off for this reason.

It was also found that such materials might undergo permanent dimensional changes when subjected to heat treatment and that their expansivities might be very different at different parts of the temperature scale. Cracking may occur if such a material is heated or cooled quickly, or strains may be set up that may cause subsequent failure.

This method and the expansivity measurements made with it are described in Scientific Paper No. 485, of the Bureau of Standards entitled "Application of the Interferometer to Measurements of the Thermal Dilation of Ceramic Materials" by G. E. Merritt. Copies may be obtained from the Supt. of Documents, Government Printing Office, Washington, D. C. The price is 5 cents.

1924 CLAY PRODUCTS CYCLOPEDIA NOW AVAILABLE

The first paragraph of the preface to the new 1924 Clay Products Cyclopedia, now published, indicates the desire of the editors that the improvements in the book shall go a long way to making it useful and valuable to the industry. This paragraph reads as follows:

"In publishing this second edition of the Clay Products Cyclopedia, we have spared neither expense nor effort to improve the book in every way possible so that it can more fully fill its mission as the standard reference hand-book for all executives of plants."

Information of Value to Everyone

A large part of the book is entirely new, and some of it has never been published previously. This new material will interest every executive in the plant. For instance, on page 76 there is a table headed, "Handy Calculations for Discounts." This is good for the Purchasing Agent, the Accountant, and those who check bills. When an invoice comes in showing a discount of 45, 10 and 5 per cent off list, ordinarily three multiplications and subtractions would be necessary. With this table it is only necessary to make one operation by deducting 54 per cent.

Everyone at times wants to know the equivalent temperatures of the Centigrade and Fahrenheit scales. It is always necessary to remember the formula, dividing by 5, multiplying by 9 and adding 32. With the table shown on page 208 of this book, all of this work is unnecessary. The exact reading of any temperature can be found in a moment and there is no chance or opportunity for error.

Glaze Formulas

Many glaze formulas and similar data have been added on pages 116, 117 and 118. Moreover, on page 7 a very complete and accurate method is explained for changing a chemical formula for a glaze into its equivalent in batch weights of commercial materials. This is especially valuable to one not possessing a technical education.

Section on Fuel Oil

The large amount of interest that is being evidenced at the present time in fuel oil is satisfied by more than three pages, 110, 111 and 112, almost all of which is entirely new. Some of it has been included only by special permission. Part of this item gives comparative properties of the various oils from the different fields of the country.

The question of storage tanks for oil is also a big item today and part of this space is devoted to this feature. Other items covered are the changes in volume of oil due to temperature—heating values of fuel oil, pounds per gallon, and so forth, for the various degrees of the Baumé hydrometer and similar data.

Likewise additional data have been inserted on the question of coal on pages 49 to 55. The report of the Bureau of Mines showing comparative properties of practically every coal field in the country is included so that manufacturers can determine the best coal for their individual use.

Catalog Section an Improvement

These are only a few of the new items in the reference or editorial section that will appeal to the various executives in a plant.

The catalog section is a very big forward step. This section contains 70 pages of condensed catalog information, giving sizes, capacities, dimensions, prices, buying specifications, requirements for certain conditions, photographs of both equipment and installation, and other details.

The Clay Products Cyclopedia is published by Industrial Publications, Inc., 407 South Dearborn Street, Chicago, and is priced at $3 per copy. The publishers will be glad to furnish any additional information desired.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	July 21—Aug.—1924	Trip to Pacific Coast
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
American Foundrymen's Association	Oct., 1924	
American Gas Association, Inc.	Oct., 1924	
British Assn. for the Advancement of Science	August 6–13, 1924	Toronto, Canada
Chemical Equipment Assn.	Sept., 1924	
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Paving Brick Assn.	Dec., 1924	
Society for Promotion of Engineering Education	July, 1924	Boulder, Colo.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)

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BULLETIN

of the

American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Mary G. Sheerer, H. S. Kirk — Art
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Vol. 3 August, 1924 No. 8

EDITORIAL

COLLABORATION IN RESEARCH

Not long ago college men in ceramics were called "high brow," "not practical." This adverse attitude toward them was the rule. Those college men who were succeeding in industrial positions were believed to have had exceptional ability or advantages. Technical research would not be tolerated. Years of experience was considered to be the only sesame to ceramic wisdom. "Trade secrets" and the "Formula Book" were jealously guarded. Manufacturers would not collaborate together.

How different it is today. Men trained to use the fundamental science data and methods are largely employed. They are considered essential even by the craftsmen. Formulae are not guarded so jealously. Manufacturers are collaborating more freely in things technical. Collective support of researches is now the rule. Ceramic manufacturers of the same sort of ware have for a few years past been supporting technical researches through their respective trade associations and now the different trade associations are to engage in joint support of technical investigations. They realize that only thus can they most quickly and most assuredly obtain lower manufacturing costs and establish the utilitarian superiority of their product.

A Ceramic Institute is almost beyond the "possibility" stage. The report of an organizing meeting in which eight associations participated

is given on page 317 of this *Bulletin*. The trade press has frequently printed notices of the developments in the idea of collective researches by trade associations. The Ceramic Institute is well nigh a reality.

Members of the American Ceramic Society must be acquainted with and assist their Society in keeping in line with this forward moving enterprise. Collective support of technical investigations has been the Society's chief aim. It cannot do else than to give this new movement every encouragement and assistance.

There is another enterprise by our ceramic trade associations which should be encouraged. In editorials and in news reports the Society has hailed with delight the idea of regional Foremen Institutes. The Refractories Manufacturers Association has for a year or more conducted quarterly meetings of Foremen Institute with resulting inspiration and information to the men who are leaders in their members' plants. Such meetings of foremen from neighboring plants manufacturing like goods by practically the same methods and equipment will surely result in lower cost of production and better quality of ware. A larger appreciation of the user's problems and a keener desire to solve them with their product is given to the factory bosses. A closer bond of mutual responsibility and a more responsive desire to assist is obtained between the salesmen and the factory foremen. These Foremen Institutes are most excellent enterprises.

There is another coöperative activity under consideration with full expectancy of early adoption. Some of the trade associations are planning for mid-year and annual meetings of the technologists from their member companies' plants to be held at the same time and place of meeting of the trade managers. This is another evidence of a rapidly growing appreciation of the money value of collaboration in technical investigations.

The American Ceramic Society cannot fail to give to these new cooperative research enterprises that same encouragement and assistance which it has given to establishment of ceramic laboratories in the federal and state institutions. There need be no worrying about overlapping of activities. Such overlapping as there will be for a while will soon disappear. That combination of joint enterprises which is best for the ceramic industries collectively will be continued. The Society has promoted these enterprises; it will align itself with them in the manner most helpful.

PAPERS AND DISCUSSIONS

ART IN INDUSTRY[1]

By Richard F. Bach

This is not an article on the business of art; nor is it concerned with the art of business. It has the simple thesis that art is worth money in trade, that art annually sells products valued in billions of dollars, that artistic design is a selling point as important in several scores of art industries as warmth is in selling wool, endurance in selling tires, health in selling cattle; in other words, that many industries count on art as an initial ingredient without which their products would not be salable.

The conception is not new; it is as old as architecture, or better, as old as personal adornment. Man has always counted heavily on appearances and, if Bryan will permit, ages of animal life from which man grew did the same before him. To count on appearances does not mean to favor externals regardless of structure beneath. Good appearance, attractive design, is not superficial in value or intent, even though actually applied on the surface. It is part of the first conception of the object.

The design of a locomotive or trip hammer or steam shovel implies its mechanical function. By comparison, the design of a chair or a lamp also implies a utilitarian purpose; and the design of a cuff link or an inkstand or a collar box maintains the same principle. Compare Peter Cooper's first "steam wagon" on the B. & O. with the iron horse that hauls the Twentieth Century from New York to Chicago. The difference is seen first in design as expressive of function, second in the effort to make the newer thing more attractive, "better looking," more appealing to the eye, which is a roundabout way of saying more satisfying to the mind. Practical hand-satisfying function has begun what more ethereal mind-satisfying design must complete. Design cannot make amends for lack of functional value. A beautifully designed stove that is not constructed for draft is neither a good stove nor a good design, because in the first place it must be useful.

Typewriters of long ago were highly decorated—with paint, but they were of limited practical value. Typewriters of today are the acme of practical value and their decoration is one of form alone. Yet compare the first Remington with the latest portable model; the advance in function has been backed up at every step by an effort to develop a better looking machine. Design has worked out from the facts, which require the maximum strength and service from the minimum of material; design subscribes to this principle of our vaunted efficiency. No doubt a great part of this effort is unconscious; that is its saving grace and greatest advantage, that is its fundamentally human quality.

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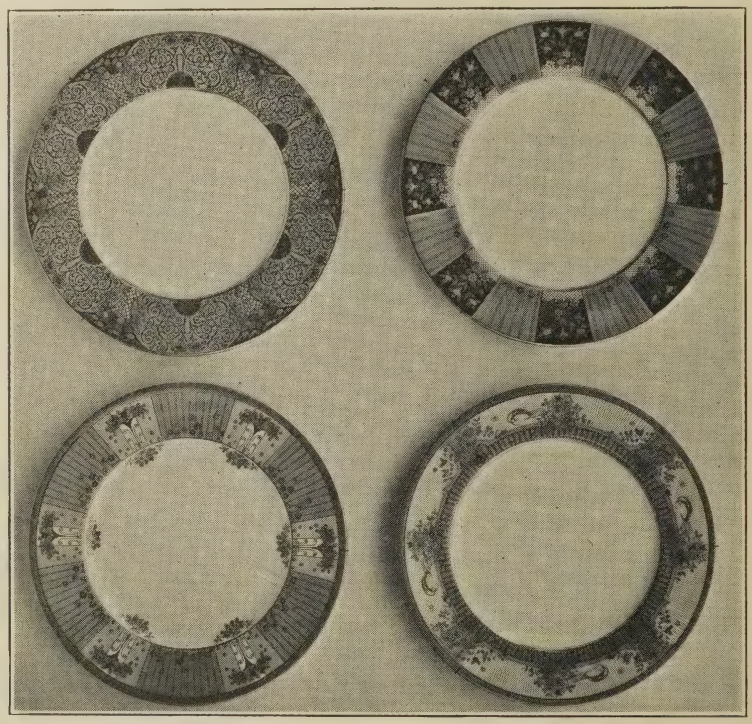
[1] Prints for this paper were furnished through courtesy of the Metropolitan Museum of Art.

Our examples above are drawn from fields in which mechanical design predominates. But design as expressive of function is just as characteristic of products in which mechanism does not count, but in which the physical function has to a great extent yielded importance to the mental. A device for mechanically squeezing oranges may be very useful without being attractive; yet as soon as it has reached a standard of performance it is made more attractive in appearance, so that it becomes an asset to the soda fountain. By contrast, a well-built safety clip and the strongest



Plates designed by Frank G. Holmes, executed by Lenox, Inc., American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.

silk string or alloy joints or patent settings are but minor considerations in a necklace. The factor of utility in the practical sense is small as compared with the mental satisfaction found in the appearance of the piece. Beauty comes into play, and in the daily grind we may call this "artistic design" as distinguished from the more directly practical design of the machine. In an ideal world, some day, there will be beauty in both, for the beauty of use and the use of beauty respond to related areas of the mind.

Artistic Designs Sell the Product

It is with the so-called "art industries" that we are here concerned, industries in which artistic design sells the product. Consider women's handbags or bathing suits, men's shirtings or cravats, ribbons, lace, flappers' scarfs, or sport clothes for both sexes, to mention but a few items in the ever-changing kaleidoscope of fashion; in these we have the most exaggerated examples of the selling value of artistic design, the commercial value of the "better looking" thing, the cash value of beauty. It is an admissible argument that in such products, created for ephemeral

China designed by Frank G. Holmes, executed by Lenox, Inc., American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.

use, the sale is quick and the beauty therefore of the same stamp; true, but the process of thought which accomplishes the purchase is the same.

Material, Execution and Design

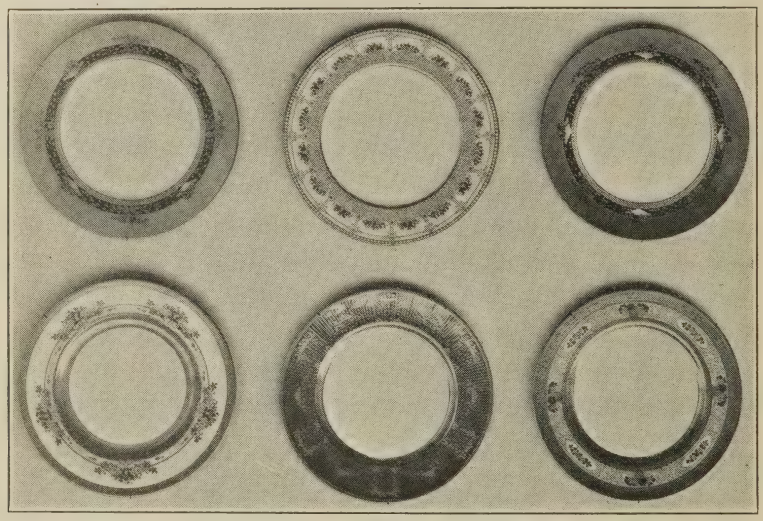
Refer the matter then to more solid things, such as rugs, armchairs, sideboards, wall paper, lighting fixtures, linoleum, upholstery fabrics and other elements in home furnishing. Here we seem to restore the balance. Material, execution and design, the controlling triad of manufacture, are seen in proper proportion.

Material, execution and design are the leading considerations that guide the product from first conception to finished piece on the salesroom floor.

Materials we know and can choose. Execution we know and can master; we have equipment and the power to control it. But what of design? In American art industries today design is the stepchild.

Design Subscribes to Mechanical Limitations

Business men have reasoned it out for themselves over and over again. The hand is too slow to supply the mass with, let us say, woven silks. Mechanical means are soon found for weaving the silk. The new toy is developed to an egregious degree; attachment follows attachment, until the apparatus is so complicated and seemingly so omnipotent as to stagger its inventors. Millions of yards are fed to its rollers and shuttles with amazing results. No one seems to notice that the



Plates designed by Frank G. Holmes, executed by Lenox, Inc., American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.

mechanism has become the master, that every design produced subscribed more and more to mechanical limitations, progressively lost vitality and artistic expression (which I hold to be the equivalent of salability); that in the end there would be a stalemate. Thousands of yards from a single motive, drawn up in a space perhaps eighteen inches square; thousands of yards of assured sales before the loom can with profit be set in motion.

This is spreading design on very thin, thought some; when one design can travel as far as that, it cannot be very important in a single yard. No, said others, the more yards you weave the more important is your design for a single repeat; the business value of the original design must be multiplied by the number of times it is used. These two opinions still

continue side by side. Those who favor the latter are still in the minority and will be until American business sees its daily loss.

Business has given much thought to raw materials, their selection, naming, storage, and preparation for use; business has also collectively studied production, processes have been standardized, the cost of a single movement of a single operative is known, machines and management hold no secrets; turnover, transportation and other details are an open book. And there business has stopped. It has gone but two-thirds of the way.

Design as a Controlling Factor in Production

Business has never collectively interested itself in design as a controlling factor in production. It has been blinded by volume, dazzled by numbers; it has made ten thousand rolls of wall paper as intelligently as it has made ten thousand kegs of shingle nails. The process has been perfect—mechanically; perfect in the same sense that the phonograph is a perfect representation of the voice. The difference is that these rolls of wall paper can in the end achieve a form of appeal which kegs of nails must forever lack, if they are to continue useful.

Coffee Server designed by Frank G. Holmes from porcelains in The Metropolitan Museum of Art; executed by Lenox, Inc., 7th Manufacturers & Designers Exhibition, 1923.

In producing this wall paper, and we could as well say carpets, candlesticks, book-bindings or ceramics, business has aimed at perfection in material and perfection of handling. Design has just "sort of come along;" worse than that, it has been neglected, forgotten, marooned and often made to walk the plank. At the same time, when a sale is made, what is the talking point that carries the greatest weight? This same design which seems insignificant at the beginning of the process of production suddenly assumes importance.

Design a Controlling Factor in Sales

The manufacturer says to the buyer from Field & Creery's: I want you to note this timber, get the weight and strength of it, the way we have treated it with this and that; then look at our construction, the finest piece of joinery to be seen in the markets of the world; then this finish, etc., etc. Meanwhile, the buyer's picture of prospective sales has granted meager space to wood and build and varnish; it has been based mainly on comfort

and convenience in use and on appearance, which is design. He has seen comparative values on the fourth floor of his store, the values that control his customers' judgment, for he knows that while a cross section of an ice box may be good evidence, the same is not true of a dressing table.

The best wood and the best construction may still make a garish rocker that the market will absorb, flamboyant carving, green plush covering and all. If that is the bull's eye for which business aims, there may be need for prayer, but there is no need for fervent paragraphs like these. The finest wood and superlative construction are powerless, even useless, certainly without character, unless they find expression in the best design. Fine design will sell poor materials and mediocre workmanship, but the opposite is false.

Coffee and Tea Set. Plates designed by Frank G. Holmes, executed by Lenox, Inc., American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art.

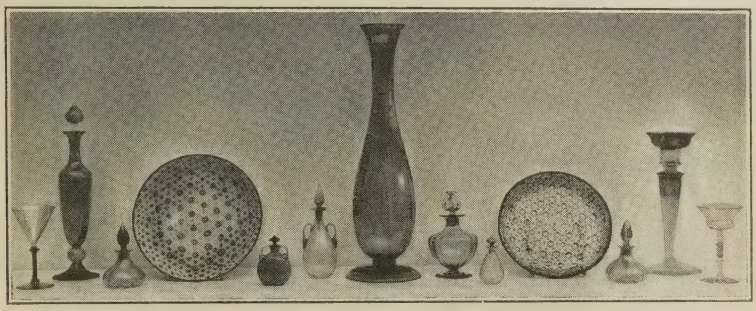
A chemical formula may be re-vamped year after year and sold under the name of perfume, if the design of the bottle keeps step and the design of the advertising backs it up: an evil example, chosen from the borderland of legitimate business, but a proof. What flimsy materials have you seen used for women's clothes, wondered at their wearing qualities and stared at their price? The design of the garment has sold them. You may take several yards of straw, some silk, wire, thread, ribbon and a few flowers, and out of this concoct a marvel of millinery. The materials may cost you five dollars; the hat will sell for fifty. Yes, there is the cost of making, labor, rent and other overhead; there is the cost of merchandising, wages, packing, and again the overhead. These may make the difference in actual figures, even though we allow a profit of only twenty-five per cent. But have any of these sold the hat? Design alone did that.

America Needs Schools of Industrial Art

A similar defense may be written for design in several scores of art industries. Costume alone, not counting uniforms or men's clothing, represents an annual outlay of American money totaling $500,000,000. Home furnishings cost a similar amount. Add to that the other types

of industrial art, printing, jewelry, building, etc., and we reach a sum which, in the language of the columnist, would buy New York. This is the consumer's outlay. The products so purchased are not always the output of American labor and skill. In this is our greatest failing.

We have for decades exported raw materials to Europe and bought back finished products from Europe. We have paid the transportation both ways. We have made our own materials climb the tariff wall to get back to us. We have paid all the intermediate profits. So these



Glass in various colors, plates in mirafiori designed by Frederick Carder, executed by Corning Glass Works, Steuben Division, American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.

Decorative glass designed by Frederick Carder, executed by Corning Glass Works, Steuben Division, American Industrial Art, 8th Annual Exhibition at The Metropolitan Museum of Art, 1924.

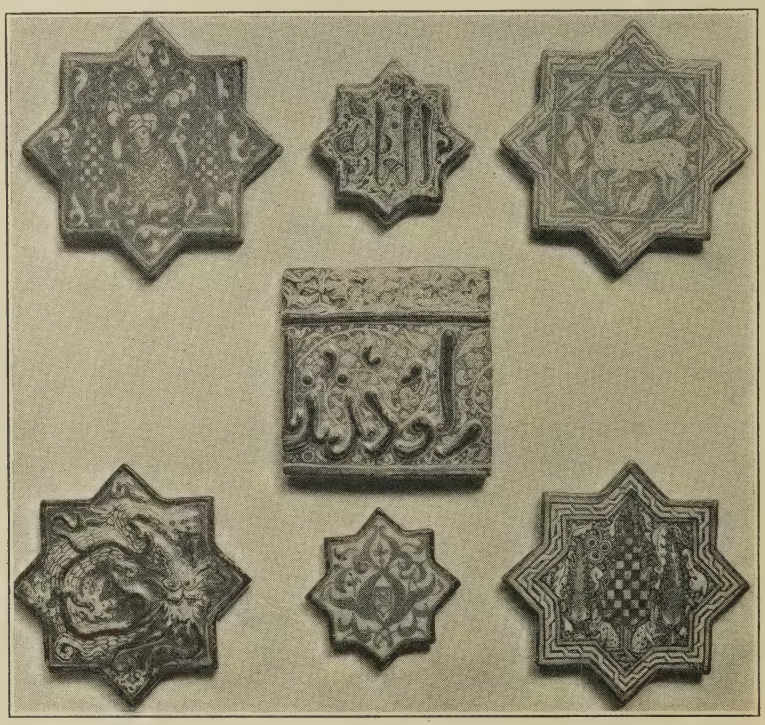
millions that are commanded by design in manufacture and sale in great part go to Europe.

Suppose you export cotton to England and buy it back as knit goods. Before the knit cotton goods gets back to us the English have added 80% to its value. They have added skill in manufacture. Americans pay this 80% and in addition Americans pay the freight, the tax, the merchandizing cost and the several profits to our own middlemen.

In printed cotton goods skill adds 125%; in pottery 290%; in clothing 500%. Skill is nothing but manipulation of material to produce the design

which commands the price in the end. We cannot say what design alone is worth. It is part of material; it is part of execution; it is a factor, not a figure by itself.

The curious thing, the un-American and inefficient thing, about the whole matter is that design has not received attention from business men. Have they founded or aided schools of industrial art? Do they coöperate with schools by linking theory with practice? Yes, one out of a thousand has done this. Business will establish a class to teach the care of cutting edges of tools and give never a thought to training the artist-artisan whose



Tiles in antique design by Rafael Guastavino. 4th Manufacturers' and Designers' Exhibition.

hand controls these cutting edges. His skill has been figured as less important than the tool he uses. I have in mind the organization chart of a knitting mill in which there are four process instructors, and only one designer.

And again, do American manufacturers favor foreign designs? Yes, many do and will persist in buying designs abroad. Do these same men in a definite, practical way aid American designers or advise their instructors? Yet their criticism of existing schools is both plentiful and caustic.

Finally, do American distributers buy American goods and sell them under a foreign label? Or do only foreign concerns with establishments in American cities grovel in this way for the dollar? These are sore spots. Time alone will not heal them. Remedy lies in constructive effort. Without this we will come more and more under the heel of Europe in many art industries.

When the war began our designing rooms were manned by foreign talent. With the first gun these designers left us as though in a single shipload. We had no substitutes. Blissful ignorance had built no bulwark against such an emergency. Business talked and prayed and hoped, mostly hoped. Not a single school was established. If any came into being, surely they are not with us now. As soon as the war ended, the orgy of exportation of

Stories by Rafael Guastavino, working in the manner of Persian luster painting.

raw materials began again and at the same time products of foreign skill crowded out American products in the stores. America has nothing to show for it—the best opportunity that ever came to a country to study its own needs. Self-examination is not our leading national trait. But there has been some progress; there are a few long heads among us, a few giants with vision, who have hewn to the line and often lost by the effort.

Sales Force and Customer Should Appreciate Design

Glib complaint is easy. We have censured producers, but we have not meant to spare distributers. Of the two, we hold the store to be the greater sinner. Stores have devoted increasing attention to selling service,

but have not taught their clerks the meaning of design. The customer knows what she likes, the clerk knows what is on the shelf; they can get together only in the matter of design; this is the common ground. So the store must extend its service in that direction. For the store stands between manufacturer and consumer, arbiter of taste for the millions, and by the same token dictator of the factory's efforts.

The consumer can hardly be blamed. How shall he find out about design? The schools do not help him gain appreciation; a handful of schools have begun to teach how to buy, which means how to discriminate between designs.

In this as in many large questions there is a vicious circle, of which the beginning is also the end. So in the present case the circle must somewhere be cut so that a beginning may be made in the direction of improving design. While for the consumer good design may mean satisfaction and

Bowls of Persian type, luster studies by Rafael Guastavino, 4th Manufacturers' and Designers' Exhibition, 1919.

peace of mind, for the merchant it will mean increased service, good will and profit; for the manufacturer a better product, a steady market, a larger working margin; and for all three a better bargain.

But the mass of consumers is too great to be quickly taught; educational systems must grow up to its needs. This they are doing, though with painful slowness. Meanwhile, our circle can be cut in two places. The producer and the dealer represent smaller workable numbers. These can, by taking advantage of existing facilities, largely educate themselves toward a higher standard in design. They can go to school with past masters of their crafts or business pursuits, for at all times art has commanded a price, design has been sold and the making of it has been a source of income.

Museums as Schools of Industrial Art

They can find resource at the museum of art. Whatever the problem, leather purse or celluloid hair ornament, candy box or umbrella handle,

coat lining, bone button, piano, kettle drum, handkerchief, talcum box, advertisement, porch chair, teapot or doorknob, no matter what type of object as to purpose, material or form, if it falls in the field of useful objects made attractive by design the museum of art can help. The accompanying illustrations show how one museum has helped in a practical way. These producers have obtained authentic information at the fountain source of design; they have figured it out that the value of their products is threefold: material, execution and design. Above all, they have come to regard a museum of art as a silent partner in business, while their designers have added its collections and facilities to their laboratory material.

Not to be outdone, certain dealers have shown a similar advance. They now attend in scores several series of conferences at which are dis-

Studies in slip and luster applied upon ordinary vessels, by Rafael Guastavino shown in 4th Manufactures' and Designers' Exhibition, 1919.

cussed the fundamentals of form and color as related to practical purposes and as expressing current selling values. And all of this on the basis of originals tested by time and preserved because of this same transcending quality of design.

Industrial Support of Art

These are but two indications of how one great public art institution works. They would not be possible if there were not fertile ground to till. And they are in themselves inconceivable without the backing of the trades. Yet they indicate plainly the Metropolitan Museum's conviction that art has a commercial value, an idea which, ludicrous as it may seem,

must yet be sold to the vast majority of producers and dealers in the art industries.

It comes to this: the art trades must stand and deliver. The American public is rapidly approaching the place where it will say: we want the best design by an American designer in all our home furnishings, in our clothes and our books; we want American-made products, no matter whence the raw material comes; we are not dazzled by the European trademark, it is no guarantee of either quality or design; we don't like *Nippon* on our teacups, *Paris* on our gowns, *Germany* on our toys; we are glad to see *Made in the U. S. A.* on these and a thousand other objects; and, finally, we are willing and able to pay for good design wherever it may be considered rightfully as adding to the cost.

Business must keep ahead of the game. The art trades must lead. The better thing must be ready before the consumer demands it. Provide excellent design and these millions will stay in America. Provide excellent design and American industry will grow.

Metropolitan Museum of Art
New York City

BALL CLAY SPECIFICATIONS[1]

By Arthur S. Watts

Ball clays are sold directly from the mine without processing, other than the air drying which may occur under favorable circumstances. The development of specifications covering the purchase of such material is rendered more difficult by the fact that the material is shipped in lumps which make the taking of a satisfactory sample exceedingly difficult.

Disagreement as to what exact properties possessed by ball clays form the basis of its commercial value increases the difficulty of developing a set of specifications satisfactory to both producer and consumer.

The following must, therefore, be looked upon as only a preliminary step in the hope that an interest may be awakened in the subject, and by constructive criticism and discussion a satisfactory conclusion reached.

The *ball clay deposit* is sedimentary and consists of numerous strata which frequently vary greatly in physical properties although perhaps not greatly in chemical composition. The different strata may or may not vary greatly in color and may be sharply defined or may merge into one another so that the lines of division may be very difficult to determine. As a rule, however, the portion of a ball clay deposit marketed under an individual name or number has a rather definite boundary although it may contain streaks or lenses of material widely different in color or other properties from the mass of the deposit. The presence of this foreign clay material as well as the presence of woody tissues further complicate the

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Whitewares Division).

sampling process. When sandy streaks or lenses occur in a deposit, the problem of sampling is made abnormally difficult since this portion air dries much more quickly than the more plastic portions and tends to sift to the bottom of a shipment and is frequently lost sight of in ordinary sampling.

The Free Water in Ball Clay

The drying of ball clay is d fficult owing to the density of the masses and unless properly conducted may even be dangerous. Some users prefer ball clay which has never dried out, claiming that it loses some of its essential properties if completely dried even though no artificial heat is employed. If properly dried, this claim is of doubtful importance when compared with the benefits derived from the use of dry clay. Few buyers of ball clay realize either the extravagance or the dangers that attend the use of wet ball clay, except under the most careful plant control.

For example, take a domestic ball clay costing $5.00 per ton f. o. b. cars at mine and carrying freight charges of $5.00 per ton. If the clay contains 20% of water, the buyer pays $10.00 for 1600 lbs. of clay or $12.50 per ton of clay. The shipper receives $1.25 for loading the water and the railroads $1.25 for hauling the same water. The receiver has also the expense of handling the water on its arrival. It would be far cheaper for the consumer to pay the shipper the difference, provided it was a means of obtaining a properly dried product.

The drying of materials at moderate or even atmospheric temperature is much better understood than was the case even a few years ago and if moderate care is exercised in mining and handling, it appears practical to have all ball clay delivered with a maximum of 5 or 6% water.

A frequent cause of variation in behavior of ceramic bodies is the water in the ball clay. We hear of many plants which claim to operate on a dry basis for all raw materials but in even the most exacting of these, a shipment of wet ball clay will be drawn on for a day or more before the scales are corrected, or a supply of wet ball clay exhausted and a dry supply drawn on which may cause even more serious results though not the same. The establishment of dry ball clay as a standard material is obviously worth while but cannot be hoped for without some concessions from both buyer and shipper.

Since, however, we find that a large portion of the ball clay delivered to our industries is distinctly wet, we must take this into consideration in developing methods of sampling, and testing for purchase and control.

Chemical Composition

While a properly made chemical analysis may furnish valuable data on a ball clay, especially as a guide in determining the uniformity of the products of a single deposit mined over a long period of time, there is doubt whether it is a safe basis for substitution even among clays from

different strata of the same deposit. Much, however, may be inferred as regards probable physical and pyrometric properties from an intelligent study of the chemical analysis and its value is not to be questioned. It is seldom practical to make a chemical analysis of a thoroughly representative sample from each car-load shipment, so that its service is limited.

Sampling

Take six samples, one two feet from each corner of the car and one from the center on each side of the doorway. See that each sample represents all colors encountered and if sandy material covers the floor, see that this is also represented. In taking samples from lumps, cut or chop a slice $^1/_2$-inch thick from each lump in the zone sampled and in proportion to the size of the lump. Each sample should exceed five pounds in weight. As soon as collected, the samples should be reduced to $^1/_4$-inch lump size by crushing or if too wet, an old-fashioned chopping bowl and knife will give quick and satisfactory results. Spread on a sampling cloth and quarter repeatedly until about one pound remains. When the six samples are thus reduced, assemble in a small enameled steel pan.

Water Content

After weighing the sample, dry at 150°F maximum temperature covering with a cloth to eliminate outside dust. After drying, reweigh, and determine percentage of water in wet clay weighed.

Sand Content and Size of Grain

To 100 grams of representative material taken from the dried sample, add 1000 grams distilled water, and heat to 125°F or as warm as the hand can comfortably endure. Agitate until the clay is thoroughly disintegrated. Cool by placing the receptacle in a dish of cold water. Add ammonia, a drop at a time, until the clay is dispersed. Remove the sand by pouring through a 200-mesh sieve, washing the residue with a little distilled water and add washings to the original liquid. Agitate the clay water mixture thoroughly and classify by means of a Schultz elutriator.

Plasticity: Viscosity, Lubrication Values, and Bonding

I believe that general opinion holds that the peculiar and especial properties of ball clays are combined in two properties, *viz.*, greasiness or lubrication, and stickiness or bonding strength. By these the mass containing ball clay is caused to mold with increased smoothness and the strength in both the plastic and dry states is increased. Since ball clays are never used alone as ceramic bodies, the determination of these properties on pure ball clay has been unsatisfactory to many as a guide to industrial application.

Viscosity

The determination of viscosity by means of the Marriot tube may have distinct value as a guide to the behavior of the clay in body and glaze composition but investigators

have not agreed on any values as standard based on data obtained with this apparatus. The following values obtained with this apparatus may prove of interest and value in this consideration.

The above values give American ball clays a higher viscosity than that of English ball clays. Some investigators have reported the reverse. I am convinced that no two operators will check on the viscosity value,

TABLE I

VISCOSITIES OF BALL CLAY-WATER MIXTURES
VISCOSITY OF DISTILLED WATER EQUALS 1.00

Clay	10%	20%	25%	30%	35%
Water	90%	80%	75%	70%	65%
		English Ball Clays			
A	1.01	1.05	1.12	1.26	1.46
B	1.01	1.03	1.06	1.13	1.33
C	....	1.01	1.04	1.09	1.19
D	....	1.05	1.09	1.17	1.33
E	....	1.04	1.07	1.13	1.33
		American Ball Clays			
A	....	1.06	1.13	1.32	1.90
B	....	1.05	1.12	1.25	1.54
C	....	1.05	1.16	1.41	....
D	....	1.09	1.18	1.22	1.34
E	....	1.10	1.20	1.36	1.54

except when working under exactly the same conditions. A difference in the time consumed in bringing the clay into complete suspension and the length of time it stands in suspension before test will make a difference of more than 10% in the values reported. This is especially true of ball clays because of their high content of adsorbed salts. It is, therefore, essential that if viscosity is used as a basis of comparison, a very definite testing procedure must be followed.

Lubrication Values Crush the dry sample until it passes a 20-mesh sieve. To one-half the dry sample add an equal weight of pulverized flint and mix thoroughly dry by screening repeatedly. To 100 cc. distilled water add this clay-flint mixture until the mass will hold its form perfectly and flow under pressure through an opening 1 x $^1/_2$ inch and emerge with smooth edges. Add flint plus 25% water until the edges of the bar produced no longer appear smooth. The percentage of flint added to the clay is the *lubrication value* and is expressed in per cent of dry flint added to 100% of dry clay.

Bonding Value This value of ball clay may be definitely determined on either the leather-hard or the bone-dry material in a number of ways. The accuracy of the data will depend upon two factors: (1) the uniformity of the test specimens, (2) the method of

test. Test specimens have been prepared in many different ways with the hope of producing a unit which will be free from laminations or other structural faults. The practice of hand molding has been proven absolutely unreliable. Casting was for a time considered but has not been generally approved. The most practical method is to produce a series of bars by the method employed for determining the lubrication value. The unused half of the dry clay sample is mixed with an equal weight of pulverized flint and the amount of water determined in the preparation of that mixture. This is made into bars by the method described and cut to 5-inch lengths. These bars, after being formed, are dried at 125° to 150°F. For leather-hard samples, the drying process is halted as soon as the pressure of the end of the finger will no longer produce a distinct impression on the surface of the bar. (Bars should be tested near the end, which is not included in the portion subjected to test.)

All cross-breaking tests are to be conducted on the Reihle testing machine, modified for cross-breaking tests, as employed in the laboratory of the Ceramic Station of the U. S. Bureau of Mines, Columbus, Ohio.

The leather-hard cross-breaking test should include a record of the load necessary to produce a distortion of $^1/_4$ inch in the center of the bar. If the time to this stage is recorded and the total time recorded, the proportion of the total load may be easily computed.

The dry cross-breaking test is conducted on bars which are dried to constant weight.

For accurate data the increase in load should not exceed 4 pounds per minute.

The cross-breaking strength or modulus of rupture is calculated by means of the formula:

$$M = \frac{3Pl}{2bd^2}$$

M = modulus of rupture
P = force applied or pressure in pounds
l = length between supports in inches
b = breadth in inches
d = depth in inches.

Shrinkages in Drying and Firing

At least three of the bars provided for the bonding value test should be carefully marked as soon as they are formed with scale for determining shrinkages. These are dried to the leather-hard stage and the shrinkage recorded. The drying is completed and the trials again measured. The shrinkage to the leather-hard and bone dry stages are expressed in per cents of the original length. The trials are then fired to cone 10 and the firing shrinkage is recorded in percentages of the dried lengths.

Color Value Ball clay should never be tested for color in the concentrated state, since its density and adsorbed salts give color intensities which are misleading.

The most satisfactory results are obtained by incorporating in a body consisting of standard materials as follows:

Potash feldspar 20%, flint 30%, English china clay 30%, ball clay to be tested 20%. This is fired at cone 10. The amount of ball clay introduced is excessive as compared to the average vitreous body but if reduced to 10 or 12%, the comparison of different clays is sometimes difficult.

For use in non-vitreous bodies, the color action may be studied in the mixture of 50% clay, 50% flint, but the data obtained cannot be readily compared to factory practice.

Vitrification Value The action of the ball clay as a flux may be studied very satisfactorily in the 50% clay—50% flint mixture, by determination of the absorption of the samples after being fired to cone 10.

Fusion Value This determination is the same as has been recommended by the Standards Committee for the test of all clays. The use of the 50% clay—50% flint mixture offers some advantages in this test and may be worthy of consideration as the rate of deformation is generally increased and the value may be more exactly determined.

Vitrification Range This consists of the range in standard pyrometric cones between the vitrification temperature and the deformation temperature both expressed in cone values. The determinations must both be made on the clay as marketed and care must be taken that the test specimens are absolutely representative. The mode of expression may, for convenience, be in cones arranged as a fraction, *e. g.*, $\frac{12}{28}$ meaning that the clay becomes non-absorbent at cone 12 and deforms at cone 28.

Development of Specifications

The development of specifications becomes a difficult task when we consider the importance which must be assigned to the various properties investigated.

The *chemical analyses* of dry ball clays has been found to vary within the following limits:

Ignition loss, 9% to 15%	CaO, 0.0% to 0.4%
SiO_2, 45% to 61%	MgO, 0.0% to 0.3%
Al_2O_3, 25% to 39%	K_2O, 0.4% to 2.0%
Fe_2O_3, 0.6% to 1.3%	Na_2O, 0.0% to 0.5%
TiO_2, 0.6% to 1.8%	

The *sand residue* (ignited) retained on a 200-mesh sieve has been found to vary from .5% to 12%.

The *grain size* of the clay passing a 200-mesh sieve has been found to vary between the following limits:

0.075 to 0.0175 mm., 2% to 7%
0.0175 to 0.0075 mm., 10% to 28%
0.0075 to 0.00175 mm., 45% to 65%
Smaller than 0.00175 mm., 7% to 40%

The *viscosities* of 25% ball clay—75% water mixtures vary from 1.04 to 1.20.

The *lubrication value* has been found to vary from 320 to 560.

The *bonding values* as indicated by the modulus of rupture have been found to vary from 160 to 470 pounds per square inch.

The *color value* has been found to vary from a commercial white through all degrees of gray, buff, yellow and brown. No definite scale of color values is offered.

The *vitrification value* of 50% clay—50% flint mixtures has been found to vary from 30% to 20%.

The *fusion value* on the clay alone is found to vary from cone 23 to cone 33.

The *vitrification range* has been found to vary between cones 11 and 18 for vitrification and cones 23 and 33 for fusion.

The limits or values are not definitely suggested since this is properly in the hands of the Standards Committee. It is probable also that they may recommend other tests than those here outlined but it would appear that the ball clay situation is sufficiently important to justify some attempt on the part of our Society to develop purchase and test specifications covering this material.

Department of Ceramics
Ohio State University
Columbus, Ohio

Discussion

Mr. Riddle: We are overlooking something that is very important, and that is the question of moisture in content of clays. There are two or three producers and sellers here, and several consumers, and it is a fine opportunity to enter into a discussion and get some real value out of this paper. It might also be advisable to present our discussion to the Standards Committee and see what they would advise. If we do that, the selling agents and producers have an opportunity right here to say what they think as to how fair it would be to buy clays on a moisture-free equivalent base.

Mr. Hendrickson: As producers we have numerous complaints. If the consumers would be willing to stand the expense, to get dry clays which

would entail a considerable amount of extra labor, equipment and handling that might solve the problem. Whether this amount would be more or less than the amount paid by the consumer on receiving the clay with more moisture than he thinks proper, is another question.

I do not think we have any figures on that subject. We know that in the winter months when the consumer does not have adequate storage space, sometimes he fails to order his material in sufficient time, necessitating mining under adverse weather conditions and at more than double the normal expense to the producer.

In the summer the consumers get a drier clay than they do in winter.

It would be an ideal thing if all ball and sagger clay mines had drying facilities and could ship dry clay. Some mines are not situated so as to have adequate space and buildings or sheds in which to dry (store) the clay.

It would cost the producers a great deal more money to have the dry clay, but if some way could be suggested and the potters could see the advantage and be willing to pay the extra costs we can see no reason why, if they want dry clay they cannot have it.

Mr. Metz: A little incident in our business may possibly be of interest here.

A certain company which ships wet concentrates, averaging around 35% moisture, found that by installing driers to dry their material before it was shipped, and even with the additional cost of drying, it was possible to allow an over-all saving of 10% just on that one item. Considering how much they concentrate in their plants, that makes quite a saving.

Has any attempt ever been made actually to dry ball clay in a machine of that type? We have been drying clays for such concerns as Langley in South Carolina, Continental Clay Company, and there might be some possibilities in the ball clay industry in drying the clay in the same manner.

Mr. Gesner: This is a problem like plasticity, you have to wrestle with it for some time before you determine what would be a suitable adjustment.

Mr. Brian: To determine a standard amount of moisture I think would be impossible without consulting the producer in England as the moisture varies very greatly.

A few years ago on one of my visits to East Liverpool, I called at a particular pottery which had just unloaded a very large car of ball clay, on which they had one of their employees playing a hose. I asked, "What are you doing that for?" The answer was, "We soak all of our ball clay." I then asked what allowance they made for this moisture in their pottery. The answer was 20%. In other words mere guess work.

Some of my Company's consumers dry all of their ball clay before they use it. There are others who dry it and then grind it.

To my mind the only safe way to use ball clay is to use it in the dry

state; then you are quite sure of your moisture content, or in other words, as near as you can possibly come to it.

Ball clay as mined is ordinarily put up in large piles, and then awaits time of shipment.

In the section of England where this particular clay is mined they have considerable rain, particularly during the fall and early spring seasons. If I want this material I am compelled to take it, and make no complaint regarding the extra moisture in same.

Recently this Company received a shipment of ball clay that contained 36% of moisture which is entirely too high; 20%, however, is a fair average. I have often taken this matter up with the producer on the other side, but his answer has always been, "How can you change conditions?"

If storage cellars were put up it would simply mean that your company as importers and others would have to pay this additional charge. I think that Mr. Gesner of the Hammill & Gillespie Co., will quite agree on the above statement.

I would suggest that the American Ceramic Society put the matter of moisture up to the importers, and then in turn put it up to the producing company in England. If you will come as a Society I feel quite sure that you will have the hearty coöperation of every importer of ball clays.

This company is with the American Ceramic Society to the limit, and also with the pottery manufacturer.

When I was over in England last November, it rained nearly every day. This company has seven shafts in operation producing ball clay. Five out of the seven shafts sunk in on account of the rain. The average shaft produced about 80 tons of clay per week when working full time.

The thought that I want to impress upon you is regarding weather conditions in England. The proper months for the consumer to secure ball clay would ordinarily be throughout the summer months, from May to October, as ordinarily this season is drier than between October and April. Of course, they do have some heavy downfalls during the summer.

The clay mined during the summer when piled up becomes very dry, containing about 15% or 20% of moisture.

The shipment is desired by an American importer, and the mine proceeds to load the material by the railroad wagons which contain anywhere from four to twelve tons. The cars used are all open cars covered with tarpaulins. The cars are then forwarded from the mine to the dock to be loaded on the vessel. The clay may be practically dry when loaded, and sent down to the ship. After arrival at the dock the tarpaulins are all removed from the cars ready for shipment to the vessel.

It may be a beautiful day when the cars arrive at the dock, but within one half hour or so after the tarpaulins have been removed down comes the rain. You will, therefore, see that even if the clay is shipped fairly dry

to the dock, there is a possibility of the clay getting saturated by the heavy rains.

The English producer has stated that he will try to secure dry clay, but what is he going to do in a case like that just mentioned?

During the War when everyone was very anxious to get all the clay possible, this company received one lot of clay that came over very much saturated. I complained to the ship-owners and after considerable discussion and various cables to the other side, I was advised that they had to put water on the slide to force the clay down into the vessel. This was caused by the clay originally being too wet to run down the slide so a little more water added to that in the clay naturally assisted the clay to be forced into the hold of the ship.

Prof. Watts: For a great many years I bought large quantities of ball clay, and I found there was no difficulty in securing ball clay with a moisture content of not exceeding 12%, provided I was willing to furnish storage space so that the ball clay could be shipped to my factory in the summer when the weather was good, and stored there.

In many plants that is very inconvenient because they have a certain place for ball clay and they do not want to go a quarter of a mile to get ball clay out of a shed and bring a carload of it in. It will probably mean that for materials such as ball clay and perhaps some American china clays it will be necessary to provide either additional space in storage bins at the factory or it will be necessary to recognize that the shipper must have storage facilities either at the plant or at the railroad where he can store his ball clay in such quantity that it will carry him through the winter months.

As a result of agitation which I developed with my sources of supply, we were able to arrange for a storage of ball clay at the bins, and it costs us about 10% more to have this clay stored at the railroad in sheds so that we can have dry ball clay. It costs us about 10% more for our ball clay. But we did not have to pay 25% more freight or pay for the handling of a lot of wet ball clay, and we were not annoyed with the problem of determining moisture on our different bins. We did not attempt to have the ball clay come down to zero moisture, but we did insist on buying ball clay on a certain basis. We had no difficulty with any ball clay shipper that we dealt with in reaching a satisfactory arrangement on the price of ball clay and we saved money on it.

I believe the same thing that we accomplished could be done by every other consumer of ball clay, if he will go at it in the right spirit with the miner.

As far as the English clay is concerned, I recognize what has been said with regard to the irregularity of the moisture content in shipments of English ball clay. I have been hearing that in increasing earnestness for

the past two or three years, and yet it goes without saying that ultimately the American consumer must pay the ocean freight on that water. The man who is handling the ball clay cannot afford to lose 36% on the price of his ball clay and 36% on the price of his transportation to New York.

The consumer has to pay for at least a part of that 36% moisture. Some constructive work could be done by our SOCIETY if we would take up this question of the water content which would be permissible and for which the consumer would agree to pay in the shipments of both foreign and domestic ball clay.

MR. ENGLE: Our firm is certainly willing to work along that line. We have often discussed the present very uneconomic practice of shipping clay three thousand miles by water and then several hundred miles by freight, and paying at least freight and many other charges on 10%, if not more, on water that should be eliminated.

Our English ball clay shipments run from 15% to 20% average moisture through the year, and they run higher when we have wet weather. The record of our last five or six shipments was around 16% or 17%.

It is not an easy thing to get the English clay mines to change their system of doing things, but I do not think that this obstacle is unsurmountable. I do not believe the English mines would dry our clay except the American consumers speak with one voice and that in a very determined manner.

CHAIRMAN BLUMENTHAL: We have heard from some of the producers and their willingness to coöperate. The SOCIETY will do all in its power to help all parties concerned. We ought to hear a few words from some of the consumers.

MR. STAUDT: There is no use wasting any time talking about it. Time is money. We have known this for years, we have been agitating for years and we have had trouble for years. We know we pay for 10% to 20%, and even as high as 25% of water.

Now, nothing is impossible. If we insist that we want to have our clay delivered with water content not more than 5% we can get it. But we do not stick together. As the Englishman says, "You have to take it, never mind whether it is 20% of water or 5%."

We bought some New Jersey ball clay at one time. There were three prices; one was for the clay that came from the filter press; one semi-dry and one bone-dry, the latter was the highest priced. We ordered that bone-dry clay because it is very important for us that we keep our moisture content down. But we received semi-dry clay and they charged for bone-dry. We had all kinds of correspondence, and they said it must have got wet on the way. The result was I paid for the bone-dry clay, got the semi-dry and had to dry it; had a whole lot of trouble, and paid my bill. And ever since we have done the same thing; have simply paid for water.

Mr. Hendrickson: Mr. Staudt, how far ahead do you anticipate your supply?

Mr. Staudt: We do not anticipate a supply very far ahead.

Mr. Hendrickson: I was not criticizing Mr. Staudt's manner in ordering his clay but if the clay consumer would give plenty of time when ordering the clay, he would undoubtedly get drier clay. If the consumers would send their orders in far enough ahead to give the producer a chance to get his orders in, I believe some of the difficulties would be overcome.

Chairman Blumenthal: The producers and importers and the consumers should get together with the Standards Committee on this proposition and see whether it cannot be worked out. I am sure that it can, because with the coöperation afforded in all branches concerned this matter can be brought to a definite understanding.

Mr. Riddle: I move that a committee be appointed by the White Wares Division to go over the details of the discussion and then present its findings and advice to the Standards Committee, and that this Committee be composed of one whom can be called neutral, and three consumers and three producers, Professor Watts to be neutral and to pick his own six men. (Motion duly seconded and carried unanimously.)

Mr. Gerber: Essentially, the great objection to moisture in clays is in the disturbance it may create in mixes when the water content varies. This certainly can be avoided very largely, by stocking clay in advance of requirements. If stored indoors the clay will gradually dry to a uniform state; if stored outdoors it can be brought in, in time to dry to the proper state. Where the user is acquainted with mining conditions, and inadvertently places rush orders during wet seasons, his lament when the clay comes soaked is scarcely in good form.

Against the uneconomic payment of freight charges on water, the clay worker to be sure has the redress of passing it on to the consumer. This admittedly is a left-handed means of escape, and yet it may easily be a debatable question whether in a great many instances the charges incidental to drying would not exceed the freight on a reasonable content of water. Inasmuch as a reasonable percentage of water is not detrimental in the uses to which clay is later put, why not leave it and arrange a scale of prices based on moisture content. Raw materials in which the presence of water is perhaps more disadvantageous than in clay, *i. e.*, iron ore, coal and coke are widely bought and sold on a dignified plane which takes into account water content. The crux of the matter is not so much the mere presence of water, nor the need of paying for water, but rather the fact that under existing conditions both of these circumstances rest on a structure of guesswork.

FELDSPAR MILLING

By W. H. Landers

A study of the monthly quotation of prices asked for crude feldspar in all districts, will demonstrate that the miller is paying more today for the rock he mills, while he has difficulty maintaining last year's prices for the ground rock he sells.

This condition is due primarily to a lack of sufficient labor at reasonable compensation, and the exhaustion of the near-by deposits of high grade mineral. The consumer can have little comfort in the situation from the standpoint of quality and price, but he has a perfect right to demand constancy in quality of milled product.

The miller must be able to draw his supply of crude feldspar from mines in the same district, and put through his plant, a definitely proportioned mixture of rock from each source, or he must have a single deposit large enough to keep his plant supplied.

He must also be constantly on the alert to see that the rock is properly sorted both at the mine, and at his mill. Conditions in each mine are liable to change from time to time, and the effect of such changes must be anticipated and provided for.

Recognizing that good rock is scarce, and labor is inefficient and high priced, the miller must have his equipment in the best of condition to produce a satisfactory and uniform product. The days when the boss miller could tell from the "feel" or "taste" of the rock that it was properly ground, have passed. The miller must have knowledge of the use of screens, test mills and other simple laboratory appliances.

The last condition is really the only one within control. Mills can be designed, built and maintained in such a manner as to reduce to a minimum the skilled labor, and can be counted on to turn out continuously a far more uniform product than was ever possible on the old-style intermittent types.

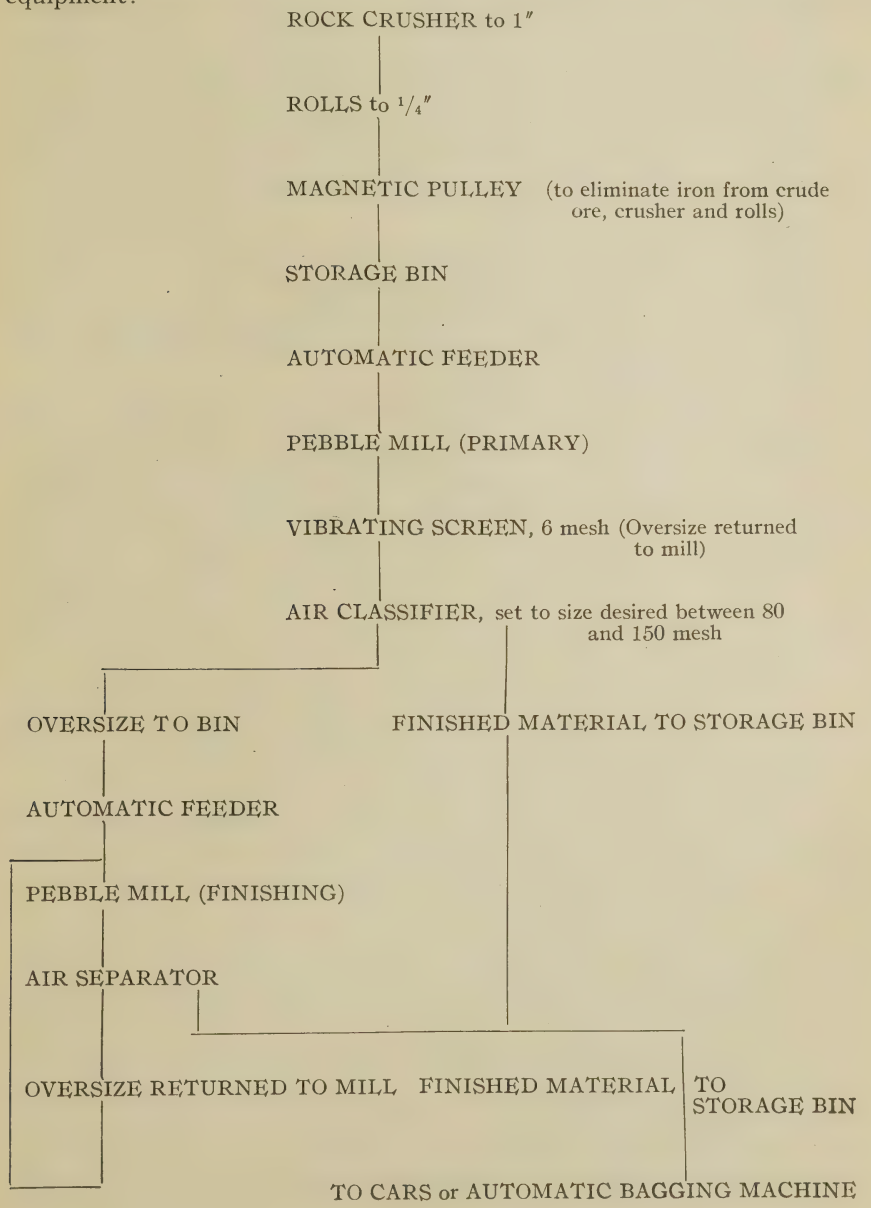
Whether or not a new piece of machinery will take less power, cost less for repairs, or is justified in its first cost, is of little importance compared to the question as to how many men it will save, and how uniform and continuous is its output.

Dry Milling Methods

All of the old-style intermittent plants are not without improvements. One now finds rock breakers in place of hand sledging, automatic feed and discharging of the chaser mills, mechanical elevation and screening, automatic return of over-size, and various mechanical conveyors of the chaser stone product to storage, and batch grinding finishing mills. The small batch mills have in some places been replaced by the larger tube

mill, generally operating as an intermittent grinder. Bins for storing the chaser mill feed, or final shipping product are occasionally found.

The highest development of feldspar milling using only apparatus now thoroughly tried out on this class of rock, would consist of the following equipment:



Chaser mills, in spite of their simplicity and small power requirements for primary grinding are gradually giving way to the continuously fed pebble mill. Although the pebble mill requires preliminary crushing, it takes less mill space and can be maintained at its highest grinding efficiency with less loss of time, money and labor, than can the chaser mills.

With the advent of the pebble mill as a primary grinder, came the vibrating screen for elimination of coarse over-size preparatory to the final grinding in the batch-finishing mill. As the use of vibrating screens developed, it was found possible to eliminate the finishing mill, when grinding to the 100-mesh for the glass and enamel trades, although finer screening to the 140-mesh pottery trade requirements could not be economically performed by screens alone.

The next step in improved milling was the air-classifier. With this the costly and troublesome fine screens were dispensed with and continuous grinding made possible. Any size product, between 80- and 150-mesh could be continuously produced with the use of one or more pebble mills attended by one man only.

A big saving in power was now possible, particularly where a small output of 3 to 4 tons per hour of 150-mesh material, was desired. This saving while not apparent when the pebble mill was used only as a primary grinder, resulted from the elimination of the batch mills or dump cylinders. Feldspar fed to the batch mills contains approximately 85% of finished material, and it is necessary to grind the entire volume for from 4 to 8 hours finally to finish the 15% of over-size. The classifying apparatus enabled the finishing mill to receive a feed containing only 10 to 20% of finished fine feldspar.

This flow sheet assumes that the crude feldspar contains less than $^1/_2$% of moisture. If this condition cannot be maintained, a small drier should be placed between the storage bin and preliminary pebble mill, or a larger drier between rolls and bins.

Such a plant can be operated by one mill man and a helper, a crusher man (one shift only) and two baggers (when shipping bagged material) and can turn out four tons an hour of 150-mesh feldspar.

Maximum Service with a Minimum Loss of Time and Repair Cost

1. Many old tube mills now operating as dump cylinders, are susceptible of conversion to continuous grinders.

2. Jaw-crushers are less expensive to buy and maintain than gyratory crushers taking the same size feed. A crusher sufficiently large to avoid hand sledging of mine rock fed to it, should be used. It is cheaper to break rock in a crusher than to do it by hand.

3. The run of mine size should not be reduced in one operation to the

small size necessary for a pebble mill. A set of rolls or specially designed gyratory fine crusher will give better satisfaction.

4. Feldspar, although one of the easiest hard minerals to break, or pulverize, is extremely abrasive and will quickly wear out any machine operating with a rubbing motion and contaminate the product with the metal.

5. Rolls if used should be big enough to nip the largest piece fed to them without undue slippage. Speed is a very important factor.

Rolls should not be expected to reduce at a greater ratio than 4 to 1.

6. Manganese steel crusher jaws or roll shells should not be used, as the following magnetic pulley will not attract manganese steel particles. Chrome is better.

7. Belt conveyors are better than bucket elevators on all material larger than 20-mesh. Bucket elevators, if necessary, should be of the belt type, and for the coarser crusher product of the continuous bucket type. Chains should never be used in material as abrasive as feldspar.

Belt conveyors avoid all such troubles and are nearly fool- and wear-proof, if properly installed.

8. A high intensity magnetic head pulley on a belt conveyor, will remove much of the mill and tramp metals.

9. Room for a good big bin to hold at least 24 hours feed for the primary grinding mill is advisable. The crusher and rolls can then be operated one shift only, and this department will be independent of the rest of the plant.

10. An automatic feeder should be installed to control feed to primary mill. The feeder usually attached to the feed end of a pebble mill is for putting feed into mill only, not for measuring its quantity.

11. Care should be taken in selecting the primary mill. Slight differences in design may effect the output as much as 30% in the case of pebble mills.

12. Except in the cases of very small installations, the primary mill should not also be a finishing mill. The two operations require different sized pebbles and consequently different sized feeds.

13. A small bin ahead of finishing mill, if possible enables repairs to be made to any part of the plant, without closing down the entire mill.

14. Sufficient storage should be provided for finished material to be independent of car supply or other transportation difficulties.

15. Grease lubrication as far as possible is best as oil is wasteful and requires more attention than it is likely to get in a dust laden atmosphere.

16. Daily screening tests, backed up by frequent fusions and analyses of the mill product, are necessary to a uniform and satisfactory product. This does not cost as much as losing customers and reselling rejected shipments.

Wet Milling

There is an almost unlimited quantity of feldspar available in the United States suitable from an alkali and alumina standpoint, but which contains sufficient garnet, hornblend, tourmaline, iron-oxide, etc., to make it unsuitable for use by the potter. Such material can be so cleaned as to give it a final quality equal to the best grade.

As the remaining first class quarries are worked out, the miller (always ultra-conservative) will be forced to turn his attention to making an acceptable product out of this lower grade feldspar. The consumer will need to coöperate in this development if there is to be any hope of lower or even equal prices for feldspar in the future.

At least one large mill has been wet grinding and cleaning feldspar in this country, while in England and Continental Europe, wet milling without cleaning, has been a regular practice for years.

From data now available, the flow sheet of such a wet grinding mill, using only standard equipment, would be as follows:

ROCK CRUSHER to 1″

ROLLS to 1/4″

MAGNETIC PULLEY

MILL BIN

AUTOMATIC FEEDER

PRIMARY PEBBLE MILL

CLASSIFIER to 30 mesh
Oversize returned to mill

CLASSIFIER OVERFLOW to
30 mesh screen to eliminate
coarse mica, chips, cinders, etc.

CONCENTRATING TABLES to remove iron bearing minerals

CLASSIFIER to desired mesh of finished material

OVERSIZE to regrinding pebble mill in closed circuit with this classifier

FINISHED MATERIAL to continuous thickener

CLEAR WATER overflow returned
THICKENED MATERIAL to

STEAM OR OIL HEATED FILM DRIER

DRIED MATERIAL to disintegrator and then to vibrating screen to remove any lumps

FINISHED MATERIAL to storage bin or bagging machine

The number of men required to operate a wet mill would be the same as in the dry milling plant, with the addition of a drier man. Its cost of operation would be slightly higher on account of the extra drying cost. As a partial offset to this would be the saving in dust losses and repairs.

Wet milling of feldspar is not revolutionary. Most of the flint used in the ceramic industry is secured from the wet grinding of quartzite in iron or steel mills. Little or no effort is made to prevent contact of the wet rock with the metal grinding material.

The subject of feldspar milling needs careful consideration. A little time and expense for research work before adopting this larger and more costly construction will repay the small cost involved.

4 West 43rd St.
New York City

REFRACTORIES QUESTION BOX[1]

E. E. Ayars, Editor

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire clay to spalling?

2. What difference is there between the properties of a soft mud machine made and a hand made brick?

[1] See note, *Bull. Amer. Ceram. Soc.*, **3** [7], 258(1924).

3. Can an iron-free clay brick be made for blast furnace service?

4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?

5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?

6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand made fire brick?

7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?

8. What is the reason for the more rapid failure, at a lower temperature, of fire brick subjected to reducing atmosphere, than will obtain with the same brick under oxidizing conditions?

9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

Question

What effect do sand and oil inclusions incident to hand molding have on the service of hand made fire brick?

Discussion

In the manufacture of fire brick by the soft mud hand repress method, one brick out of every three contains sand cracks due to the fact that the third brick is made from the caps from the two previous brick.

Some recent tests show that these sand cracks cause the brick to spall.

Spalling Test

Brick free from sand cracks	Brick with sand cracks
Lost 2% on 10 dips	Lost 3% on 10 dips
Lost 2% on 10 dips	Lost 3% on 10 dips
Lost 3% on 10 dips	Lost 10% on 10 dips
Lost 3% on 10 dips	Lost 60% on 8 dips
Lost 3% on 10 dips	Lost 10% on 10 dips

In service the brick with sand cracks spall considerably more than brick free from sand cracks.

Oil is even more sure to cause spalling than sand. We have some photographs in our laboratory showing how brick with oil cracks behaved in the reheating test preliminary to a spalling test. They were cracked to pieces and when the same brick were put in service in a boiler furnace they spalled badly. Brick free from oil cracks placed in the same furnace did not spall.

We are therefore of the opinion that fire brick would give much better service if they could be made free of sand and oil cracks.—C. E. Bales, Louisville Fire Brick Works.

Question

What is the cause of the rapid failure of fire brick in the checkerwork baffles of oil fired boilers, subjected to a temperature of 2300°F but against which the flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this the result of reducing conditions?

Discussion

The effects noted on the checkerwork baffles of the oil-fired boilers is probably chiefly due to the fluxing action of alkalies in the oil. Practically all the fuel oil from the mid-continent fields has a quite substantial content of alkalies which are either originally present in the oil or added by the refiners in the process of distillation. These alkalies have a strong fluxing action on fire brick especially those of a siliceous nature. The action is much less marked on fire brick composed of flint clays without any excess of free silica.

The heavy Mexican oils (12 to 16 gravity Bé.) do not appear to have the alkali content of the mid-continent oils either because they do not have it in the first place or because owing to the fact that they are merely topped for gasoline and not used for the distillation of lubricating oils, it is not added by the refiners.

The effect in the case under consideration is probably made still worse by strongly reducing conditions from time to time. Failure will always take place at a lower temperature under reducing than under oxidizing conditions.—Phillip Dressler, American Dressler Tunnel Kiln Co.

It does not appear at all likely that there is any time when a reducing condition exists in the checkerwork baffles of a boiler, as it is through these checkers that the air to support combustion enters and the flame burns several inches above the grate line. There should be an excess of oxygen at all times in and around the checkers.

The alkalies in the oil seem to be the cause of failure.

The following data on oil fired boilers is of interest. One large southern electric power company is firing a 16 gravity Bé. topped Mexican oil. The boilers are a Babcock and Wilcox three pass, horizontal tube with lateral drums. The combustion chamber bottom is so designed as to eliminate as much as possible the slagging of checkerwork baffles. Back shot burners are used. These project from the bridge wall and the flame is directed toward the front wall of the boiler, air being admitted through the checkers under the flame. Less than half the area between the front wall and bridge wall is given over to checkers, and these lie directly against the front wall. The rear section of the bottom lying against the bridge wall is made up of old brick laid in loosely, the surface sloping gently toward the checkerwork. At the junction of checkerwork and sloping bottom a slag dam is built. This catches the slag which runs from the fur-

nace walls and prevents such slag from getting to the checkerwork. The slag and loose brickwork is easily removed, without damage to the checkers. It requires six months to a year for the slag pocket to fill.

The only trouble with slagging in the checkers is occasioned by oil dripping directly on them from a poor burner, and this does not often occur. However it should be noted that if the oil does have access to the brick for very long they will slag badly.

Brick in use are from one Missouri manufacturer and from one manufacturer in the Olive Hill, Kentucky district. Good service is obtained from either. Both dry press and hand molded brick have been used but no apparent difference in service is noticeable. The dry press brick lay up into a better looking wall as far as joints are concerned and are on that account used more than the hand made product. It has been found that the usual prejudice against dry press brick in oil fired furnaces has no support in actual service in this case at least. The clays employed in making the brick have more to do with the service than the method of manufacture, or at least the method of manufacture does not appear to effect the service. The brick are laid with a thin joint. Some commercial fire cements and washes have been applied to the walls with more or less success but are not found necessary to secure good fire-brick service.

In early installations the wall construction consisted of four header courses and one stretcher course. Insufficient expansion joints were allowed and the side and front walls showed a tendency to split through the middle, half of the wall falling into the fire-box. The bridge wall also split in two parts. The use of large anchor tile did not prove effective in correcting the trouble.

Latterly by changing the wall construction to alternate header and stretcher courses, and making a more liberal allowance for expansion this fault has been overcome.

The chief engineer expressed the opinion that with a good first quality brick the matter of service depended more on the design, construction and operation of the installation than anything else.

Constant changes are being made in their equipment of 10 boilers to secure the best efficiency, the principal one of which consists in raising the entire boiler several feet above the flame. Greater fuel efficiency will result with redesign of the boiler setting. The steam atomizing burners will be replaced by mechanical burners, which will also improve the combustion conditions.

The opinion has been expressed that the new installation will be more severe on fire brick than the present one on account of the extra weight of the setting. This will undoubtedly cause bulging and some chipping of brick when the wall is heated up. To offset the effect of pressure at high temperatures, the erosion effect of the steam and oil blast will be elim-

inated by the use of mechanical burners and there will be less slagging. Without doubt the brick now in use will be absolutely satisfactory inasmuch as the temperatures will go no higher (3000° to 3100°F) than they do at present and there will be less local heating effects to meet in the higher setting.

It has been noted that soot deposits have more or less effect on brick, as well as on the boiler itself. Soot forms in various places when burners fail to work perfectly.

When the boiler is taken off and cooled moisture collects in the soot combining with it to form sulphuric acid. The acid attacks the brickwork, eating through the glazed surface and forming a rotten spongy mass which is easily scraped away. Eventually the thickness of one or more brick over the area affected may be destroyed by recurring deposits of soot.

Another public utilities plant is equipped with 600 h.p. Edgemoor cross drum boilers set 13 feet, 9 inches above the floor line clearing grates 11 feet, 9 inches. These boilers are fired with rear shot steam atomizing burners set in the front wall. Mexican topped fuel oil of the following specifications is used. Gravity 16 Bé.; viscosity (Engler) at 100°F barely fluid; as 212°F 9.55; flash point 285°; sulphur $1^1/_2$% to $2^1/_2$%; water and sediment less than 1%; B.t.u. per pound 18,000. No analysis of salts and alkalies is available.

The refractories used are furnished by a Missouri producer.

The 9-inch brick of which the entire fire-box lining is made are laid up in fire clay slip with a thin rubbed joint. The clay was furnished by the brick manufacturer.

During three years of service with the boilers averaging 300 per cent efficiency not a single fire brick has been replaced in the fire-box lining. No spalling has been noted and no slagging or erosion of the walls has occurred. They are now in perfect condition. There have been no replacements of brick in the bridge wall to date.

The checkerwork baffles are placed under the flame only and fan out toward the bridge wall. The idea is to supply a definite amount of air to all parts of the flame. There is no slagging, except that caused by a bad burner occasionally, and the only replacements have been occasioned by breakage while cleaning.

It is interesting to note that in the two cases cited above both companies have been using the same brick and the same fuel oil. One boiler is equipped with rear shot burners while the other uses the back shot burner. The main cause of failures in the first case is method of wall construction and lack of proper expansion allowance. It appears that the back shot burner is more severe on refractories than the rear shot burner inasmuch as the first case has a history of considerable slagging, even in short runs, while the second case shows none in three years service. The fact that the boilers of the first case were set low, especially early in the

game, has some bearing on the slagging of the fire-box lining and shows the effect of local heating.

From the experience of the second company with their original high settings it would appear that refractories service will be less severe with high settings than with low, in spite of the somewhat greater pressure on the brickwork. Without doubt the effects of vibration on the setting will be more marked in the case of a high setting.

Mexican fuel oil contains little alkali but carries a high percentage of sulphur. As a result there is more corrosion of steel and brickwork than with most other fuel oils, but less fluxing action of alkaline residue on the refractories. According to information furnished by a large oil company the mid-continent fuel oils are rapidly disappearing from the market and Mexican oils will soon be used exclusively, except in the case of various large consumers of lubricants whose fuel oil requirements have been contracted for some time in advance by the companies furnishing their oils and greases. Thus it appears that the undesirable oils from the standpoint of refractories service will be automatically eliminated. Some experiments have been tried using commercial high temperature cements for laying mortar and patching. These trials have met with more or less success but the cements have been no more satisfactory than the prepared clays furnished by the brick manufacturer for such purposes.

The work of the Navy Fuel Oil Testing Station on selection of fire brick for marine purposes of the Navy is valuable to all power plant consumers of fuel oil. Any brick passing the Similative Service Test should give satisfactory service in power plant service, as marine service appears to be easily the more strenuous of the two. Placing a boiler in, or taking it out of, service and operating it at various capacity ratings, contributes more to refractory lining failures than continual operation at high ratings of efficiency. The power plant should therefore have excellent results with any brick acceptable to the Navy.

Some interesting data, collected by the Navy Department, appeared in an article by Norton and Porter, "The Method of Selecting Refractories for Marine Purposes of the Navy."[1] The average chemical analysis, weights, colors, grog sizes and fusion points of brick which passed the Similative Service Test are summarized, together with some reasons for failures of brick which did not meet requirements. Readers should refer to this article and review the data set forth.—Ed.

Brick for Oil-fired Boiler Furnaces

Fire bricks to be used in oil-fired boiler furnaces should be able to withstand extremely high temperatures, changes in temperature, should undergo

[1] *Jour. Amer. Ceram. Soc.*, **7** [7], 575–582(1924).

no volume changes in service, and should be uniform in chemical composition, physical properties and dimensions, especially in thickness.

The fire clay fields of Eastern Kentucky produce flint, semi-flint and plastic clays. It has been pointed out by various investigators that the refractoriness of a brick depends upon the heat resisting ability of the bond clay and as the Kentucky semi-flint clay has the same fusion point as the flint clay, it is very evident that a much better brick should be made from semi-flint clay than from flint and plastic clays. Furthermore, the semi-flint clay in Kentucky is much more uniform in composition than the flint.

We have found that semi-flint clay made into brick by the dry press process gives a product that gives excellent results in oil-fired furnaces. The properties of the brick are as follows:

Screen analysis		Chemical analyses	
Retained on No. 10 sieve	3.6	Silica	52.28
Retained on No. 20 sieve	21.9	Alumina	42.54
Retained on No. 40 sieve	13.0	Iron Oxide	2.10
Retained on No. 60 sieve	7.3	Titania	1.52
Retained on No. 100 sieve	7.6	Lime	0.38
Passed through No. 100 sieve	46.6	Magnesia	0.40
		Alkalies	0.80
	100.0%		100.02%

Fusion point—Cone 32–33	Porosity—17.55%
Spalling test—Loss on 10 dips—8%	Absorption—8.13%
Compression in load test—4%	Apparent density—2.20
Modulus of rupture—1648 lbs. per sq. in.	Reheating test 0.00 to 0.12% expansion

The U. S. Navy Department has used this type of brick in oil-fired furnaces for several years and the Argentina Navy is using these brick at the present time. A great many sugar mills in Cuba are also using these brick in oil-fired boiler furnaces.

The writer recently saw some oil-fired boilers where the conditions were very severe. They were rated at 750 h.p. but with the type of oil burner used, they could be raised to 1000 h.p. in 15 minutes. Needless to say, such a high temperature necessary to produce so much steam is very destructive to the fire-brick lining. In this case a dense dry pressed brick far outlasted hand made bricks.

In general, it would seem that a brick to be successful in oil-fired furnaces must be dense, hard burned and made from highly refractory clays.—C. E. Bales, Louisville Fire Brick Works.

THE CERAMIC INDUSTRY IN CZECHOSLOVAKIA

By Rudolf Barta[1]

Raw Materials

It was the great riches in excellent ceramic raw materials which enabled the Czechoslovak ceramic industry to become an important factor in the international market. One of the most important Czechoslovak raw materials is china clay. The yearly production is about 400,000 tons and therefore Czechoslovakia is one of the largest china clay producers in the world. Well known is the china clay of Sedlice (Zettlitz) near Karlovy Vary (Carlsbad). It is almost kaolinitic, and is distinguished by wonderful plasticity. It contains about 99.3–99.8% kaolinite and its chemical composition is as follows:

	Per cent		Per cent
SiO_2	45.92	CaO	0.15
Al_2O_3	38.17	MgO	0.11
Fe_2O_3	0.50	KNaO	1.10
TiO_2	0.05	Ignition Loss	13.95

China clays are used for porcelain, faience, paper and ultramarine. In 1922 218,472 tons were exported.

There are the refractory clays and ball clays from Vildštajn Lížany (Lischnitz), Měcholupy (Michelob), Blansko, etc., for domestic consumption and export. The Germans, Austrians, Magyars and the states of the Little Entente cannot do without them.

Czechoslovakia produced 500,000 tons of refractory clays, of which 112,000 tons were exported in 1922. The best clays, the refractoriness of which is cone 35, have chemical composition as follows:

Clay	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	KNaO	Ingition Loss	Cone
Vildštajn	46.35	38.77	1.11	....	....	0.33	13.44	35
Měcholupy	46.42	36.67	0.56	....	....	....	15.68	35
Lížany	46.05	38.19	1.29	....	....	0.63	13.80	35
Blansko	50.03	35.29	1.57	0.42	0.49	0.50	12.05	34

Basic refractories are produced of 80% shale and 20% plastic clay. The best shale is of Rakovnik. It is in great export demand. The yearly production is about 500,000 tons. The largest customer is Germany. The shale of Rakovnik is distinguished by a high amount of alumina. It has a refractoriness of cones 36 and 37. The shale of Janušov in Moravia is bauxitic with refractoriness of cone 37.

The chemical composition is:

Shale	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	KNaO	Ignition Loss	Cone
Rakovnik	52.50	45.22	0.81	....	....	0.50	0.78	36
Janušov	43.38	42.07	0.80	0.18	0.20	0.21	14.25	37

[1] Secretary of the Czechoslovak Ceramic Society.

Silica Brick

These are produced of glacial quartzites found in northern Bohemia. Bohemia is noted for its excellent silica brick. This bespeaks the excellent quality of Czechoslovakian silica refractories. It is in great demand abroad. The Czechoslovakian factories mix several kinds of quartzites, including those of the Silur formation.

The silica brick have a volume variation of only about 1%. The chemical composition of a glacial quartzite is as follows:

	Per cent		Per cent
SiO_2	97–79	MgO	0.19
Al_2O_3	1.41	KNaO	0.39
Fe_2O_3	0.13	Ignition Loss	0.25
CaO	0.11		

Magnesite Refractories

World known is the Czechoslovakian magnesite. Before the War it was sold in international market as Austrian magnesite. The yearly production is about 10,000 tons, of which 30% is exported, principally to America. The chemical composition of a calcined magnesite is:

	Per cent		Per cent
MgO	87.60	SiO_2	3.03
CaO	2.25	R_2O_3	7.12

Feldspar

Czechoslovakia is after America and Scandinavia the world's greatest producer of feldspar. 30,000 tons are produced yearly. 6521 tons were exported in 1922. The Czechoslovakian feldspar is mostly the veiny orthoclase of a great purity. The best is from the country of Meclov. Its composition is:

	Per cent		Per cent
SiO_2	63.78	MgO	0.07
Al_2O_3	21.41	K_2O	12.45
Fe_2O_3	0.15	Na_2O	1.25
CaO	0.12	Ignition Loss	0.29

Ceramic Products

Porcelain is made in 70 larger factories and in many smaller ones. Faugeron tunnel kilns are used for biscuit and Fürbringer kilns for glazing. Yearly production is about 50,000 tons.

The insulators of Czechoslovakia have dielectric resistance to 200,000 volts.

Refractories

Gas kilns are most used. The annual production is about 80,000 tons of which 44,716 tons were exported in 1922. Czechoslovakian specialty is refractories for high temperature furnaces.

Wall tiles and stove tiles are produced in 20 large factories and in many smaller ones. Annual production is about 20,000 tons. Some of these tiles are produced largely from china clay, others of clay mixtures. The first firing is made in periodic kilns and the second in muffle or tunnel kilns. They are exported to the whole world.

Floor Tiles These are produced without admixture from a clay from Breštany. Its composition is:

	Per cent		Per cent
SiO_2	64.49	CaO	2.70
Al_2O_3	10.70	MgO	0.34
TiO_2	0.51	KNaO	2.81
Fe_2O_3	1.51	Ignition Loss	7.90

The normal sizes of floor tiles are 15 × 15 cm.

Sewer pipes are made in 16 large factories, the annual production is 5500 tons, of which 4100 are exported. The pipes are glazed inside with clay-glaze and whole with salt-glaze. They are exported principally to the Balkans, Austria, Poland, Magyarie, Roumania and Turkey.

Brick and Tiles Aluvial clays, slates and loess are used in the production of building brick and tiles. The size of the brick are 29 × 14.7 cm. or 24 × 12 × 6 cm. Face brick are seldom made. The yearly production is about 2,000,000,000 brick and more than 200,000,000 tiles. They are exported to the neighboring states.

Cement is produced in 12 large factories with yearly capacity of 1,000,000 tons of Portland cement and of 200,000 tons of other kinds of cement. In 1922 there were exported to Germany, Austria, Holland, South America and English and Dutch colonies 32,342 tons of Portland cement and 7155 tons of other kinds of cement.

It is clinkered in rotary kilns. Kilns with automatic grates are being used lately for producing cements.

The special cements of Czechoslovakia have a strength 500 kg./cm. in two days.

Lime More than 300 lime factories burn about 90,000 tons of lime, of which about 10% are exported to Magyarie and Germany. The best limes are from the neighborhood of Praha.

Instruction and Science

In Czechoslovakia ceramics is taught in 2 high schools in Praha and Brno, in 5 industrial schools in Bechyně, Plzen, Telc, Teplice and Znojmo.

The most important scientific institution is Institute for the Silicate Industries, conducted by Professor Dr. Ing. O. Kallauner in Brno. It ranks with the best in Europe.

There are also the Institute for Glass and Ceramics at the Polytechnic School in Praha, conducted by Professor Dr. Ing. J. Burian, and the Station of Portland Cement Manufactories in Brno.

The technical sections of Union of Brick Industries, Union of Lime Industries, Association of Cement Manufactories, and ceramic group of Czechoslovakian Manufacturers are engaged in scientific work.

The standardization is done by Czechoslovak Society for Testing Materials, especially in the section II geologie, III stones, IV ceramics.

Ceramic section of Massaryk Academy of Labor conducts apprenticeship courses.

Some months ago the Czechoslovak Ceramic Society was founded, similarly organized as the American and English Ceramic Societies. It has the support of all ceramic activities, educational and trade.

Among the noted scientific workers in Czechoslovakia are Dr. Ing. O. Kallauner, Dr. Ing. Jos. Matějka, Dr. Ing. Jar. Matějka, Dr. Ing. J. Burian, Dr. Ing. J. Preller, Dr. Ing. F. Fischer, Ing. K. Hineis, Ing. J. Brabec, Ing. Stašek, Ing. Svoboda, Dr. Ing. Simáně and Dr. Ing. R. Barta; in ceramic raw materials, Ing. Splíchal, Ing. Purkyně and Ing. Gaertner, etc.

ACTIVITIES OF THE SOCIETY

MEMBERSHIP WORKERS RECORD

	Personal	Corporation		Personal	Corporation
Charles A. Bloomfield	1		Frank G. Roberts	2	
George P. Fackt	1		John Sawyer	1	
C. W. Fernholtz	1		C. Saxton	1	
H. A. Huisken		1	Frederick Stanger	1	
R. M. King	1		Office	4	1
A. Malinovsky		1		—	–
W. G. Owen	1		Total	14	3

NEW MEMBERS RECEIVED FROM JUNE 15 TO JULY 15

PERSONAL

Beebe, Alan P., 729 Meldrum Ave., Detroit, Mich., Secy., Peninsular Grinding Wheel Co.

Cady, Clifford C., 2806 W. Ave. 33, Los Angeles, Calif.

Cathro, Samuel P., Box 427, Santa Monica, Calif.

De la Mora, Victoria, Balderas 44, Mexico D. F., Chief of the Ceramic Division, Laboratorio Industrial Experimental.

Goudy, Harry C., 707 Arlington Ave., Baltimore, Md., Charge of Enameling Dept., Baltimore Gas Appliance & Mfg. Co.

Goulding-Brown, H., 28 Titchborne St., Hyde Park, London, W 2, England, Consultant for Technical Publicity, Borax Consolidated, Ltd.

Griffiths, Wm. G., Oak Hill, Ohio, Secretary and General Manager, The Pyro Clay Products Co.

Johnson, Oscar H., % Mine & Smelter Supply Co., Denver, Colo., Manager Marcy Mill Dept.

Keenan, John F., 408 21st St., San Diego, Calif.

Krausse, Charles C., Cons. G. E. L. & P. Co., Lexington Bldg., Baltimore, Md., Supt., Industrial Fuel Sales.

MacGee, Alfred E., 1501 Neil Ave., Columbus, Ohio, Student.

Morgan, Charles N., 357 First St., Troy, N. Y., President and Manager, McLeod & Henry Co.

Morse, George T., 502 George St., New Brunswick, N. J., Sales Representative, Enterprise White Clay Co.

Stimpson, Clarence A., % Chicago Pneumatic Tool Co., Century Bldg., Chicago, Ill., Special Representative.

CORPORATIONS

Chicago Hardware Foundry Co., N. Chicago, Ill., J. A. De Celle.

Los Angeles Gas & Electric Corp., Aliso and Center Sts., Los Angeles, Calif., M. J. Cereghino.

Washington Iron Works, 1141 Mateo St., Los Angeles, Calif., E. H. Graham.

1924 SUMMER TRIP TO WEST COAST

As announced, this trip has been postponed. Decision to postpone was made with profound regret by President R. D. Landrum and General Committee Chairman Fred B. Ortman. Their decision was based on the scarcity of reservations by eastern

ceramists of position and note. The wonderful entertainment planned by our western members would not justify anything short of a liberal representation of eastern ceramists.

After the decision had been made and before the notice of postponement of the trip could have been received by the members four additional prominent ceramists asked for reservations for themselves and wives. Perhaps the postponing was too hasty but without reservations in hand on time schedule after the advertising efforts that were made and especially after the most excellent boosting by all of the ceramic trade papers, surely no one could blame Messrs. Landrum and Ortman.

But there is going to be a summer meeting in Los Angeles this fall. Two days of technical sessions and pleasure trips; feasts for the minds and the tired bodies; a real vacational meeting of men together having like industrial problems. All of this and more is the promise made by Fred Ortman in the name of his western colleagues. Notice of this meeting will be mailed immediately on receipt of schedule from the western committees. Excursion rates will be in force through October. The western members have written that their cordial invitation to their eastern fellows continues. A cordial welcome will be given at any time to anyone who has his Society membership card but a more enjoyable and more profitable time will be yours if you will plan to meet them in Los Angeles when the western members will have their special "open house."

NOTES AND NEWS

REPORT OF THE PRELIMINARY ORGANIZATION MEETING OF THE CLAY PRODUCTS INSTITUTE

Held in the Hotel LaSalle, Chicago, July 8, 1924

Following a meeting of the representatives from the various clay products industries at Washington on May 2nd and pursuant to a call by Mr. R. D. T. Hollowell, Acting Secretary, a meeting was held at the Hotel LaSalle, Chicago, July 8th at 10:00 A.M. with the following attendance:

American Face Brick Association: F. W. Butterworth, F. T. Owens, Wm. C. Koch, R. D. T. Hollowell, Secretary.

Clay Products Association: Fred L. Dickey, Geo. C. D. Lenth, Secretary.

Common Brick Manufacturers' Association: W. G. Bohnsack; Chas. A. Bowen, Asst. Secretary, Wm. Carver, Architect.

Eastern Clay Products Association: H. T. Shelley, Secretary.

Hollow Building Tile Association: J. T. Howington, J. L. Murphy, J. J. Amos, J. S. Sleeper, Secretary.

National Paving Brick Manufacturers' Association: O. W. Renkert, W. P. Whitney, Charles Francis, W. P. Blair, Edward E. Duff, Secretary.

National Terra Cotta Society: H. J. Lucas, B. S. Radcliffe, F. B. Ortman.

Refractories Manufacturers' Association: Arthur P. Taylor, M. C. Booze, Frederic W. Donohoe, Secretary.

Mr. Hollowell called the meeting to order by stating that at Washington it seemed to be the consensus of opinion that there were great possibilities for coöperative research on common problems of the various clay products industries and that this meeting was called for the purpose of discussing organization.

Thereupon F. W. Butterworth was elected temporary Chairman and J. S. Sleeper temporary Secretary. The roll call disclosed the fact that of the ten associations to whom invitations had been extended, eight were represented.

Ross C. Purdy, Secretary of the AMERICAN CERAMIC SOCIETY offered a proposal from that organization for a close affiliation. On account of the length of his statement it is not included in this report. R. D. Landrum, President of the SOCIETY, also spoke briefly on the subject.

The meeting then went into executive session whereupon it was decided that the organization should first be perfected and that the question of ways, means and affiliations should be taken up later.

Mr. Owens moved that the name of the organization be the CLAY PRODUCTS INSTITUTE. This was seconded by Mr. Donohoe and carried.

On motion of Mr. Howington, seconded by Mr. Dickey and carried, it was decided that details pertaining to the By-Laws and Constitution be referred to a Committee composed of one member and the Secretary from each Association.

Chairman Butterworth then introduced Mr. P. H. Bates of the Bureau of Standards who outlined briefly the organization of the Bureau and the facilities it offered. He described the confusion and duplication that occurred when it was necessary for the Bureau to deal with the individual manufacturer rather than the industry as a whole. He spoke very highly of the proposed Institute stating that it would offer a single point of contact which would enable the Bureau to serve the clay products industries much more efficiently than it has in the past. He stated further that he thought the organization should be on broad lines so that it could handle not only research work but promotion and service work as well.

That the delegates might carry back to their associations a tentative statement of the object of the proposed organization the Chairman appointed a special committee to formulate such a statement which they did as follows:

The following paragraphs are intended to reflect the sentiments of the organization meeting of the CLAY PRODUCTS INSTITUTE:

They are to be submitted to the general Organization Committee, consisting of the Secretary and an Executive Member of each of the coöperating associations.

It is understood that the Organization Committee is not and cannot be in any way bound to specific action in regard to any of these declarations of principles.

The purposes of the CLAY PRODUCTS INSTITUTE shall be:

(1) The development of the clay products industry.

(2) To provide means for coöperative research work for

(*a*) the improvement of its products,

(*b*) the reduction of manufacturing costs,

(*c*) to insure better service and consequent public economies.

(3) To afford a point of contact with Government Bureaus and such institutions and organizations as may be found to be helpful in carrying out the purposes as herein set forth.

Upon motion made by Mr. Dickey, seconded by Mr. Renkert and duly carried the report was adopted.

Mr. Dickey then moved that the temporary organization be held intact until a meeting for permanent organization be held and that such a meeting be held in Chicago at the Hotel LaSalle at 10:00 A.M., October 17, 1924. This was seconded by Mr. Howington and carried.

Upon motion made by Mr. Donohoe, seconded by Mr. Lenth and carried it was decided that the Organization Committee meet in Chicago on October 16th at 10:00 A.M. to prepare their report for the meeting on the 17th.

It was then moved by Mr. Dickey that the preliminary expenses should not exceed $500 per association and that following the October meeting a full schedule of the ac-

tivities and annual expenses would be submitted to each association participating. This was seconded by Mr. Koch and carried.

Mr. Howington moved that Mr. Butterworth act Ex-officio as chairman of the Organization Committee. This was seconded by Mr. Dickey and carried.

The possibilities of accomplishment were then briefly and informally discussed by a spokesman from each association following which the meeting adjourned.

J. S. Sleeper, *Temporary Secretary.*

RESOLUTION FOR CERAMIC INSTITUTE

At a meeting of the Executive Committee of the New Jersey Clay Workers Association and Eastern Section of the American Ceramic Society held at the Trenton Country Club, Trenton, N. J., on June 20, 1924, the Secretary was instructed to forward copies of a resolution, as follows, to the Secretary and members of the Board of Trustees of the American Ceramic Society:

RESOLVED: It is the concensus of opinion of the members of the Executive Committee of the New Jersey Clay Workers Association and Eastern Section of the American Ceramic Society that the functions of the proposed Ceramic Institute can be carried out by the American Ceramic Society as at present constituted, through its Industrial Divisions and Local Sections.

SOCIETY OF GLASS TECHNOLOGY

During the last week of May a party of some 20 members of the Chambre Syndicale des Maîtres de Verreries de France paid a visit to England at the invitation of the Society of Glass Technology, thus returning a visit paid last year to France by members of the British Society.

The program included visits to glass works, to Harrow School, to the British Empire Exhibition at Wembley and to the Department of Glass Technology of the University of Sheffield. On Tuesday evening the delegates were entertained to dinner in London on the occasion of the annual dinner of the Society. The other guests were Dr. E. F. Armstrong, F.R.S. (President of the Society of Chemical Industry), Judge F. E. Bradley, LL.D. (Master of the Glaziers Company), J. Holland, Esq. (President of the Ceramic Society), and Dr. C. Baring Horwood (Master of the Glass Sellers Company).

During the week two meetings were held. The first was held in University College London, on Tuesday, May 27, and was a joint meeting with the British Society of Master Glass Painters. The President of the latter Society, the Earl of Crawford and Balcarres, was in the chair and was supported by Col. S. C. Halse, C.M.G. President of the Society of Glass Technology. Three papers were presented.

1. Dr. Ethel Mellor, in a paper entitled "The Decay of Window Glass from the Point of View of Lichenous Growths" gave an interesting account of the acceleration of the decay of glass in ancient stained glass windows by the growth of lichens which made their habitat on the glass. Numerous specimens of these were exhibited and the paper was illustrated by a number of slides.

2. Mr. Noël Heaton, B.Sc., contributed a paper on "The Decay of Mediaeval Stained Glass." He referred to the wide variations in resistance to decay found in mediaeval stained glass. He considered that this was to be attributed mainly to variations in the composition and physical structure of the glass used.

Window glass was introduced by the Romans, who arrived at a very sound composition, and their glass was remarkably durable. Analyses of glass of different periods revealed the differences in composition which resulted from a departure from the Roman tradition in mediaeval times. The resulting loss of durability was illustrated by a series of slides. The lowest ebb was reached about the end of the 14th century, one of the most notable examples being the glass of York Minster, which was in such an extreme state of decay as to require the most careful supervision in its repair.

In the process of decay two causes operated simultaneously; surface weathering due to atmospheric action, and well defined pitting due to the structure of the glass. The variations found in stained glass of the same period was attributed mainly to primitive methods of manufacture, with certain affecting causes. It was characteristic of mediaeval glass that the painted portions resisted decay better than the glass itself, which might be attributed to the lead silicate used uniting with the glass to form a more durable composition. The reverse was the case in later times, the enamel often perishing while the glass remained sound.

3. The last paper was "The Weathering and Decay of Glass" by Prof. W. E. S. Turner, D.Sc. Ancient observers, attributed the decay of glass to various causes, some to the moon, others again to the sun. Even as recently as 1879, James Fowler in his well known treatise on this subject made a minute examination of the decay of glasses of different epochs without being able to come to any precise conclusion. But the nature of the corrosion of glass has been methodically studied by the physical chemist, and the principal causes were now fairly well known.

The chief agent of the action of the atmosphere was moisture. All glassware absorbed moisture to an extent dependent in the first place on its composition, but partly also on the manner in which it had been treated by the workman. Glasses with little stability were those which contained excessive proportions of alkaline oxides, whether of sodium or potassium. Glass of the type silica-soda-lime (such as window glass and ordinary sheet glass) which contained more than 18% of sodium oxide too readily decayed; at the same time the presence of at least 2% of potassium oxide permitted the total alkaline oxides to be increased to 20% without serious danger.

The components which increased the resistance to decay of ordinary glasses were silica, lime, alumina and magnesia. Boric oxide was also very beneficial in a proportion of less than 12%. The eventual hollowing out and the furrowing of glass in process of decay were associated with the mechanical treatment which it had received.

The second meeting was held in the Applied Science Department, Sheffield University, on Thursday, May 29. Col. S. C. Halse, C.M.G. in the chair. The following three papers were presented:

1. "Alumino-Silica Minerals in Fired Glass Pots," by W. J. Rees, B.Sc.Tech., F.I.C.

N. L. Bowen and J. W. Greig of the Geophysical Laboratory, Washington, U. S. A., had recently revised the investigations previously made on the binary system Al_2O_3-SiO_2. They showed that there was only one compound of alumina and silica which was stable at high temperatures. This compound had a composition $3Al_2O_3.2SiO_2$, and chemically was quite distinct from sillimanite (Al_2O_3-SiO_2), although its optical and crystallographic characteristics were almost the same. The crystals of so called sillimanite which were found in the different kinds of fired refractory material and in the ceramic articles were always crystals of the compound $3Al_2O_3.2SiO_2$. Researches made by the author (Mr. Rees) during the firing of pots, and blocks from glass works, as well as during their use at high temperature, corroborated the results obtained by Bowen and Greig. The proportion of $3Al_2O_3.2SiO_2$ which were found in refractory materials after firing depended upon the composition of the material, upon the degree and duration of the heating, and upon contact with, or absorption of, siliceous matter such as glass.

2. "The Effect of Various Constituents on the Viscosity of Glass." by S. English, M.Sc.

To the glass manufacturer, the viscosity of molten glass is perhaps the most important of its properties, as it is the viscosity and the way in which it varies with alteration of temperature that determine whether a glass can be satisfactorily melted, planed and worked. Though the importance of this property has been realized, the practical difficulties of measuring the viscosity at temperatures up to 1400 has prevented the subject being systematically investigated. Results have been published of only a few determinations, and the data provided do not always appear to be consistent, though it is not easy to test this point as the composition of the glasses are not generally given.

Of the various methods which have been used or suggested for the determination of the viscosity of liquids the "rotation" method seems to be the most useful for glass as it can be used over such a large range of viscosity. In applying this method, the glass was melted from cullet in a standard sized cylindrical crucible, and an iridioplatinum sheath secured on the end of a porcelain rod was rotated on its own axis in the center of the crucible of glass. The time required for the iridioplatinum sheath to complete one rotation under different loads at various temperatures was determined, and the viscosity was given as a function of the product of the net effective pull and the time of rotation. The apparatus was calibrated by using syrup, the viscosity of which had been previously determined.

The glasses used consisted of a series soda-lime-silicates obtained by a molecular substituting lime for sodium oxide in a simple sodium silicate, and a similar series in which the sodium oxide was substituted by magnesia.

The curves for the viscosities from about 750° to 1400°C show the way in which the viscosity is increased by substitution, and decreased by a rise of temperature.

3. "The Thermal Endurance of Glass. Part I." by V. H. Stott, M.Sc.

In spite of its practical importance the theory of the thermal endurance of isotropic bodies had been somewhat neglected. A theory was submitted, which however owing to the complexity of the phenomena involved, was necessarily not entirely satisfactory. Actually it was possible to increase the thermal endurance of glass by a suitable thermal treatment, but a general method for effecting this could not be given. Another question of practical utility, which could not be determined in a general way, was that of finding the shapes of glassware which were most resistant to thermal shock in the limits imposed by usage. Here again, each case had to be specially considered. It seemed therefore that, from the point of view of thermal endurance, they could choose a glass which suited a given purpose according to its physical properties, but it was most difficult to determine the best process of manufacture for an actual article, or to arrive at a proper method of testing the value of the object made. It was therefore not desirable at present to fix any formal method of testing.

Part II. By V. H. Stott, M.Sc., and Edith Irvine, B.Sc.

Experiments were made which showed that rupture was generally due to local differences of temperature, rather than to the uniform shrinkage of large surfaces. Although this interpretation of the experiments showed that the conditions assumed in the first part of the paper were not strictly fulfilled, the effects of the different factors were not greatly changed, and the formula cited would give satisfactory comparative results. In particular, since rupture was almost instantaneous, the conductivity of glass could not have great importance.

The last meeting of the Society of Glass Technology for the session 1923–24 was held in Sheffield, on June 18th, the President, Col. S. C. Halse, C.M.G., in the chair. Two papers were presented.

(*a*) "Some Remarks on the Erection and Operation of Modern Pot Furnaces," by Percival Marson. In the absence of the author, this paper was read by Prof. W. E. S. Turner, D.Sc.

The author pointed out that the glass manufacturer, before constructing a pot furnace, which represented so heavy a capital expenditure, should have adequate plans prepared. A furnace builder who knew his business should be able to guarantee his furnace, but in any case it was desirable to have a technologist as intermediary in order that suitable specifications might be laid down and adhered to. Among other things the builder should study the nature of the ground upon which the furnace was to be erected and he should construct an adequate foundation, providing also any necessary drainage and protection of the flues from ingress of water. The provision of suitable flue dampers with some form of indicator allowed of a more accurate regulation of the furnace during working. A small hole in the furnace above one of the pots served to give an indication, by observation of the issuing flame, of the state of combustion, so that correct conditions could thereby be attained. For a "full crystal" glass a furnace temperature of 1306° was sufficient and nothing was gained by exceeding this, but for soda-lime glass a temperature of 1400° could be maintained with advantage. It was claimed that for the crystal glass a circular pot was better than an oval or egg-shaped one, since it was less likely to cause cords in the glass.

(*b*) "Note on an Unusual Type of Recuperative Tank Furnace," by F. W. Hodkin, B.Sc. and Prof. W. E. S. Turner, D.Sc. This paper was presented by Mr. Hodkin who gave an account of observations made upon a recuperative tank furnace in operation at the Belinda Works of Messrs. Law & Shaw, Ltd., Leeds. The observations were made as the result of an invitation extended by Mr. J. S. Shaw to Prof. Turner to inspect the furnace.

The main feature of interest was the method of recuperation of the secondary air. This air entered by arched passages situated beneath the bottom of the tank and above similar passages conveying the exit gases to the chimney flue. It then passed by means of vertical channels in the working end of the furnace to a space between an upper and a lower crown. After traversing the space between the crowns, the air entered the furnace through a series of ports which were placed so as to have the gas ports between them.

Producer gas was admitted, without preheating, through a gas-chamber connected with ports or burners opening into the melting end of the furnace. The flames traversed the whole length of the furnace, the products of combustion escaping through vertical downtakes in the working end to the flues beneath the tank.

The batch was charged through an opening at the side of the furnace and one big advantage claimed for the method of construction was that it permitted of working operations being conducted along the walls, not only of the working end, but also of the melting end, by the use in the latter of syphons.

The tank had a double bridge. In other words, the bridge had three walls separated by cavities through which steam was blown for cooling purposes.

With gas at 700°C and air at 720°C, the temperature of the glass in the melting end was 1460°C. The production of glass from the tank, which was not being worked at full capacity, averaged 60 tons per week for a consumption of about 60 tons of coal on the producers. This glass was worked by three machines with feeders situated in the working end of the furnace, and by hands from four boots in the melting end. The designers anticipated a production of more than 120 tons of glass per week when working fully.

The President intimated that a party of members of the Society was visiting Belgium from July 7th to 12th.

REPORT ON SHORTAGE OF COAL COMMITTEE

New York, July 6.—Danger of coal famine will be eliminated, industry stabilized, railroads relieved and the consumer's coal bill ultimately cut by seasonal storage of coal, it is asserted in the report of the Storage of Coal Committee of the American Engineering Council made public here today.

"The storage of coal," the report declares, "is essentially necessary as an aid to the solution of the national coal problem, and is an economic and practicable means of insuring an adequate supply of coal as needed."

"If each coal consumer will adopt the policy of annually purchasing coal on a uniform monthly delivery basis, there will result automatically sufficient seasonal storage to guarantee coal to the consumer, as needed. Furthermore, this policy will bring about a uniform demand for coal whereby the coal producer and carrier may establish uniform and standard production and shipment schedules."

"It will also remove the evils of intermittent operation of coal mines, frequent panicky market conditions, and coal shortages due to inability of the carriers to meet peak demands."

Seasonal storage of coal by consumers, the committee finds, is an economic and practical means of insuring an adequate supply and satisfactory quality of coal when needed. "The irregularity in coal production," the report continues, "is largely due to seasonal demand. Since more coal is consumed in the late fall and in the winter than at other periods, coal producers and carriers each year are confronted alternately with a feast and a famine—with an inordinate demand for coal and transportation followed by a period of no demand. This seasonal demand is responsible for forty-seven per cent of the idle time of the coal industry."

"Seasonal demand also contributes to another very disturbing element, namely, the over-development of mine capacity through opening too many mines. Coal production capacity is now twice as large as the consumption capacity. The two factors—intermittent or seasonal operation and over-development—are in a very large measure responsible for the ills of the coal industry."

The report, given out by Ex-Governor James Hartness of Vermont, president of the American Engineering Council, comprises about 110,000 words. It was prepared by a main Committee of the Council, headed by W. L. Abbott of Chicago, working with the Department of Commerce, the U. S. Coal Commission, and federal, state and municipal agencies as well as private enterprise.

Sixty-seven sub-committees, functioning in every important industrial center in the United States, and comprising 400 individual engineers, constituted the field organization which carried on the nationwide survey for more than a year.

The report sets forth "a simple and practical remedy," saying that it is the coal consumer who must start the cycle that will bring about a stabilized industry.

"The amount of storage required to produce these corrective and constructive results," the Committee declares in summarizing its conclusions, "is small in terms of the per cent of annual consumption. For seasonal storage, from nine to ten per cent of the annual consumption is all that is required. If this amount is supplemented by additional reserve storage of no more than seven per cent, there will result an accumulation of some 83,000,000 tons of coal in storage by September 30 of each year. The practicability of this amount of storage with but slight additional outlay for equipment is indicated by the fact that in September, 1923, 56,000,000 tons were in storage."

"Equipment has been developed and may be secured to meet any storage situation or requirement. The cost of such equipment ranges from a few cents per ton of capacity up to $2.50 or $3.00 per ton of capacity."

"Storage of coal present no serious risk of loss from breakage, spontaneous combustion, or loss of heat value or firing qualities. All kinds of coal have been and may be successfully stored. The insignificant money loss due to the factors named above should not deter any one from storing coal. Application of the simple and inexpensive regulations and practices set forth in this report will provide all reasonable safeguards against such possible losses."

"The cost of storage per ton, including fixed charges on equipment, maintenance and operation expense and interest on investment in coal as well as taxes and insurance, in most instances does not exceed seventy-five cents per ton yearly. More generally it is around fifty cents per ton yearly. This cost is insignificant when distributed over annual consumption."

"Storing of coal may be easily financed. Banks will finance such an investment as readily as any other commercial undertaking."

"The transportation facilities of the United States are adequate normal and regular movement of coal. For short periods the railways can move coal at an abnormal rate, but this is both expensive and detrimental to shipment or other commodities and to normal freight movement."

"To increase transportation facilities to meet the peak demands resulting from the prevailing unsystematic practice in coal shipment would require an additional investment of some $12,000,000,000. Such an investment is not justified."

"The railroads have more to gain by storing coal than any other class of consumer. They should store their own coal on such a scale and at such times as to obviate the movement of company or non-revenue producing coal during the period when there is a heavy demand for the transportation of revenue producing freight. They should abandon, however, the uneconomic practice of using freight cars for storing coal and thereby withholding railroad equipment from other uses."

"In general, storage should take place at the point of use, to accomplish the most in relieving transportation and safeguarding supply. However, under some circumstances, storage-in-transit or at an intermediate point is advisable."

"In general, storage at mines is not recommended, but there should be sufficient mine storage facilities and capacity to overcome ordinary operating delays, such as belated arrival of cars, temporary break down or idleness of mining equipment and the like. Such provisions would materially increase the producing hours of mines and miners."

"Cars should be assigned to mines upon the basis of coal actually sold and not upon rated capacity of production. This measure would be a wholesome deterrent to overdevelopment of coal producing facilities."

"While this study refers primarily to industrial consumers of bituminous coal, yet householders have also a direct responsibility. Indeed the householder is in a position to aid with the least cost, because no special equipment for storing and reclaiming is required and his individual investment in coal is relatively small. Householders use approximately 50,000,000 tons of bituminous coal annually, which, if placed in their bins by the end of September of each year would materially contribute to the solution of the coal problem."

"Federal, state, city and other civic divisions of the body politic are not meeting their responsibility in relation to the seasonal storage of coal. They are as derelict in regard to seasonal storage as are other users and frequently add to a confused situation by securing priority orders. Public officials should take the lead, by precept and by example, in furthering the storage of coal."

"Contracts for coal should be observed with fidelity. The evil practice of indiscriminate breaking of coal contracts has seriously injured the American coal industry

with reference alike to production, transportation and consumption. Contracts for coal should be observed with the same good faith as universally prevails in regard to other forms of commercial contracts."

"Confirmation of the practicability of coal storage is afforded by the anthracite coal industry. This industry is far more stable than the bituminous, because producers, carriers and consumers of anthracite coal for a number of years have alike encouraged and practiced storage."

The committee recommends that all coal consumers purchase their coal on an annual contract for yearly requirements with a provision that the coal be delivered monthly in equal allotments. It urges that consumers provide necessary storage facilities to meet the terms of such contract.

"These recommendations," the report points out, "are based upon the finding that the purchase of coal upon a uniform monthly delivery basis will result in a condition whereby coal mines may inaugurate and maintain a regular production schedule; carriers may plan definitely as regards both schedules and equipment for a uniform movement of coal; stocks of coal automatically will accumulate during the months from April to September inclusive in sufficient amount to meet the extra consumption during the winter months; a reduction in the price of coal will be made possible by more regular schedules of production and transportation and by elimination of peak demands in the winter months when the costs of both production and transportation are the highest."

The committee reiterates, says the statement of findings given out by Ex-Governor Hartness, that the coal consumers through seasonally storing coal can and should initiate this vitally necessary cycle of changes.

The personnel of the committee of the American Engineering Council which conducted the investigation follows:

W. L. Abbott, chief operating engineer of the Commonwealth Edison Company of Chicago, chairman; H. Foster Bain, Director of the Bureau of Mines, Washington; William Hutton Blauvelt, consulting engineer, New York City; W. H. Hoyt, chief engineer of Duluth, Missabo and Northern Railway Company, Duluth, Minn.; William J. Jenkins, vice-president and general manager of the Consolidated Coal Company, of St. Louis; David Moffat Myers, consulting engineer, New York City; Prof. S. W. Parr, University of Illinois, Urbana; Dean Perley F. Walker, University of Kansas, Lawrence; Roy V. Wright, editor of the *Railway Age Gazette*, New York; Edgar S. Nethercut, secretary of the Western Society of Engineers, Chicago; O. P. Hood, U. S. Bureau of Mines, Washington.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY		
(Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
American Foundrymen's Association	Oct., 1924	
American Gas Association, Inc.	Oct., 1924	
British Assn. for the Advancement of Science	August 6–13, 1924	Toronto, Canada
Chemical Equipment Assn.	Sept., 1924	
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Paving Brick Assn.	Dec., 1924	
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)

ANNOUNCEMENT

1924 SUMMER MEETING

AMERICAN CERAMIC SOCIETY

October 6 and 7
Los Angeles, California
Biltmore Hotel

Morning and afternoon sessions for reading of papers and discussions

---

Dinner Meeting Tuesday Evening

Inspection of Plants in the Vicinity

Railroad excursion rates with the usual stop-over privileges

The cordial invitation of the western plant owners to come and see how they are manufacturing is still yours to accept.

Let's Go! A Big Time Awaits You
Informational, Inspirational, Vacational

For details write Fred B. Ortman, General Chairman Summer Meeting, Tropico Potteries, Inc., Glendale, Calif., or Ross C. Purdy, General Secretary, Lord Hall, O. S. U., Columbus, Ohio

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

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G. E. Barton, A. N. Finn — Glass
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EDITORIAL

THIRTY YEARS OF COLLEGIATE TRAINING IN CERAMIC ENGINEERING

It was in September, 1894, thirty years ago, that Professor Edward Orton, Jr. first sat before a class in "ceramic engineering." This was a unique event; the beginning of a system which in time was to be valued by the ceramic plant owners, although then little appreciated. That young professor had no way of visioning what would be accomplished in thirty years; sufficient was the faith in the opportunities for which he and his "boys" were preparing. Their faith has been justified.

When the first class was called to order, Professor Orton had already contributed largely to the advance which has since been made in ceramic technology. A cursory review of the thirty years which have followed will encourage and enthuse for the larger accomplishments yet to be realized. Such a review will be worth making, and as surely as it is made so surely will no small debt of gratitude be felt and no few words of appreciation be spoken of the foresightedness and ability to accomplish which made possible the meeting of that first class in ceramic engineering in 1894.

Ten collegiate institutions of learning in this country, and one in Canada, now have similar courses in ceramic engineering. Georgia, Penn State and North Carolina have established courses within the past year. At all

of these institutions the students are made acquainted with those fundamental sciences which are basic in ceramic engineering. They are trained in the use of facts in the solving of ceramic problems. The pupils learn the methods whereby these fundamental data are obtained, where they are recorded, and the engineering use which they serve.

Of greatest value is the training received by the students in the use of data. The fundamental facts may be only hazily remembered, but the methods of using them in the solving of problems and in the constructing of things according to the fundamental laws applying, is permanently acquired and is the real essence of the training received. Facts regarding gases, combustion, drafts, flue systems, etc., are essential, but of more importance is ability to design efficient kilns and furnaces. The knowing how to construct a workable unit and make a serviceable product is more essential than the remembering of detailed fundamental facts. The ability to use fundamental data and laws requires only the training of common sense and judgment. This same common sense and judgment is possessed by many persons employed in ceramics without the opportunity of collegiate training; it is the same common sense which promotes from the bench to plant managership.

Professor Orton used to tell his classes in those early years that a collegiate training was no sure short cut to industrial leadership, nor were the experiences had in the class room a substitute for factory experience. The truth of this is more apparent today than it was thirty years ago. Collegiate training in the solving of construction and fabricating problems in ceramics is merely the acquainting of the students with the sources and records of fundamental facts and the means of using them. Judgment in the selection and use of facts in the solving of problems can come only through experience.

Collegiate training cannot take the place of native common sense. The sad record of graduates of universities gives emphasis to the importance of native common sense.

What the ceramic manufacturers lacked thirty years ago, and what they lack to a very large extent today, is a familiarity with the fundamental principles underlying the chemistry and engineering in manufacturing, and particularly the lack of knowledge of how to use these fundamentals.

In contrast to the situation thirty years ago, when the graduates of the collegiate ceramic department could find employment only at a day laborer's wage and did not have the confidence of the employer, ceramic plant owners are now seeking the services of these graduates. It is the testimony of the directors of the several ceramic departments of the universities that their demand for men is in excess of the supply. The service which the men trained in the colleges can render is today more appreciated, and yet there has been no adequate demonstration by these graduates of

the sort of service which will be possible when we shall have learned better how to use the fundamental sciences in the solving of our plant problems.

In comparison with the graduates of other technical and engineering courses, the graduates of the ceramic departments have done well. Maximum and minimum wages earned compare favorably with those of the others, as does the percentage of graduates who finally acquire financial substance and managerial or executive positions. But there is no satisfaction which can rightfully be had in this situation. It merely indicates that such as has been accomplished through collegiate training in ceramics has been worth while. There is a very serious need of taking stock of the situation. There is a need for a frank and studious consideration of how the colleges should prepare their pupils for industrial service. The number of schools giving ceramic courses is multiplying rapidly. Other large institutions are considering establishing ceramic departments. In justice to the pupils who are going to apply to these schools for the training, and to the tax payer who is to meet the expenses and to the ceramic manufacturers who are to employ their graduates, very careful thought should be given to the best and most productive methods of training these pupils for service.

The method of training outlined by Professor Orton thirty years ago is still in use without any great amount of change. The schools are still taking the students through the same steps. They are approaching the problems of compounding of ceramic mixtures from the raw material standpoint rather than from the properties which the manufactured ware should possess. Fabricated wares must have more than appearance; they must possess very definite properties in order to withstand specific destructive influences in their use. Electrical porcelains must have shape, strength and other properties to withstand the stresses and strains, not only mechanical and electrical, but also climatic. Nearly every ceramic ware has its own peculiar destructive agencies to withstand in use. An understanding of the conditions of use of the ceramic products is just as essential as an understanding of the manufacturing processes, and certainly just as essential as an understanding of the composition peculiar in each case.

A review of the problems being undertaken by the Federal Bureaus and by the several industrial laboratories reveals that the major portion of them deal directly with the use of the products and means of so compounding and constructing the products as to withstand the destructive influences in use. These are just as much within the sphere of ceramic engineering as is the construction of plants and the production of wares. The need of these sorts of studies is just being revealed, and with the realization of this need, there surely will be a remodeling of the courses of studies in the university ceramic departments.

As the number of schools increases with the demand for more trained men, and with the enlarging of the scope and use of the Federal Bureaus, the Mellon Institute and other research agencies giving special attention to ceramics, there is a growing appreciation on the part of the plant owners of this sort of service. It is a matter of record that notwithstanding the very large amount of research work and routine testing done by the Fellows of the Refractories Manufacturers Association at Mellon Institute, there has been an increasing number of technical men employed by the refractories manufacturers, not alone in the plants, but also in the sales forces. Increase in employment of technically trained men naturally follows the proving of the value of such employment.

The organizing of plant owners through their respective trade associations in an Institute for the purpose of collaborating in research is the latest and most interesting result of the beginnings which were made thirty years ago in that first class in ceramic engineering conducted by Professor Edward Orton, Jr. Closed doors, hidden notebooks and sealed lips were almost universal thirty years ago; and in contrast, the manufacturers today visit each other's plants, compare notes and discuss freely their technical problems. Rather than guarding jealously their information so as to retain what they suppose to be a vital reason for their employment, the "experts" today are conferring one with another and exchanging information. They find that there is altogether too little knowledge of the fundamentals involved and too little knowledge had by any one of the best methods of applying fundamentals, and that the ability which distinguishes one man from another lies not so much in the knowledge possessed as in common sense in the use of knowledge.

Schools in ceramics will multiply, and the number of research laboratories, both private and semi-public and State operated will increase. We have just entered upon the era of organized collaboration among manufacturers.

Because Ohio State University was the place where collegiate training was first inaugurated, the officers at this University have asked ceramic manufacturers and the several ceramic schools to join with them in the celebration of the thirtieth anniversary of the beginnings of collegiate training in ceramics. The American Ceramic Society is going to coöperate with the University by meeting on the campus during the week of this anniversary celebration. It is fitting that we review analytically the progress made, but it is far more fitting that we analyze the need of the day and the need of tomorrow in the matter of collegiate training of men, not only for the factories, but also for the laboratories.

The time of this celebration will be the week of February 16 to 21, 1925 inclusive, and the place will be Ohio State University, Columbus, Ohio.

PAPERS AND DISCUSSIONS

MINING OF INDIANA CLAY FOR TERRA COTTA[1]

By L. Behrendt

In the manufacture of terra cotta the supply and uniformity of the raw material are of prime importance. It is needless to say that clay is the chief raw material and to obtain a uniform and suitable supply is of prime importance to the terra cotta manufacturer. Terra cotta is fired to temperatures varying from cone 01, to 7 or 8, depending upon the available clays. The experience of the writer has been limited to the Central District and all statements made in this paper refer only to the conditions prevailing in that section. The terra cotta there is made from a clay which contains a sufficient fluxing material to give a very hard and strong body at cone 01, or 1. This clay is a coal-measure clay. It is obtained from the mining sections in and around Clay County, Indiana.

In the Indiana clay and coal field the uppermost stratum is a yellowish clay, covered with a thin layer of humus. This stratum varies from five to twelve feet in thickness. Immediately below this is a hard shale of a bluish color more uniform in thickness and of an average depth of about twelve feet. This shale rests on a vein of coal varying from two and a half to four feet in thickness. This is properly the third stratum, although, in some places, there is a seam of hard pan or conglomerate between the shale and the coal. This is of some importance as the presence of this hard pan is the source of much trouble and worry to the steam-shovel operator. On the market this coal is known as upper vein block coal. It is a good kiln coal and the screenings are used for boiler purposes. The fourth stratum which is immediately below the coal is a buff burning clay, which is used for manufacturing terra cotta. This stratum due to the conditions prevailing at the time it was deposited, varies in composition. The thickness of the clay in this stratum suitable for terra cotta purposes varies from eight to thirty inches. Beneath the terra cotta clay is found a layer of so-called kidney stones, imbedded in the clay, which varies from three to twelve inches. The lower part of this stratum is a highly siliceous material. The layer of terra cotta clay varies in thickness within small areas throughout the district. The seventh stratum is a blue shale which varies from fifteen to thirty feet in thickness, which might be used for making brick and other dark colored building material. The eighth stratum is what is called the lower vein block coal and varies from two and a half to three feet in thickness. Beneath this coal is found another stratum of clay which at one time was used exclusively by the terra cotta manufacturers.

Two distinct methods of operation are used in the mining of Indiana

[1] Presented by Mr. Thurlimann at the Atlantic City Meeting, Feb., 1924 (Terra Cotta Division).

clay and block coal. First, shaft mining and second, open mining, by stripping the overburden. Shaft mining is far more difficult in the block coal mines of Indiana because as a general rule the overburden does not make a sufficiently strong roof to afford safety in working without very heavy timbering. On the other hand, since the overburden is not very deep, stripping operations are far more satisfactory and economical and are in general use in that region.

The stripping is accomplished by means of a steam-shovel usually of large size so that the bucket will pick up about three and a half cubic yards of the overburden at one time. This is then dropped on the ground where the coal and clay have been removed. The loading of the coal and clay is done by a steam-shovel which is capable of loading from twenty to thirty cars of coal or clay per day of eight hours, but never actually reaches that capacity because the coal and clay cannot be moved away fast enough. In the mining of the clay great care is necessary on the part of the steam-shovel operator to get all the clay without picking up any of the clay iron balls or kidney stones.

Coal mining operations have been carried on in this district for about sixty years. The thicker veins were naturally the first to be worked. The best clays were found beneath the thick coal measures. At the present time there are only a few of the first and second coal measures being operated.

The quality of clay in this district varies so much that it is necessary for the laboratories to make tests on most all cars that are received at the plant. The so-called rubber clay is objectionable because it is hard to mold and it cracks badly in drying. The highly siliceous clays cause cooling cracks. Some of the clays have a high sulphur content, which is present either as pyrites or in the form of soluble sulphates.

Some of these clays, particularly the lower vein burn to a salmon color. The difficulties encountered by the presence of pyrites are blistering and greenish black spots on the enameled surface of the ware. When present as soluble sulphates, the salts are brought to the surface in drying and the slips and enamels do not adhere to the surface of the ware and the result is peeling.

Midland Terra Cotta Co.,
Chicago, Illinois

WHAT IS THE EFFECT OF SELENIUM DECOLORIZER ON THE TANK BLOCKS[1]

By H. L. Dixon

Mr. Dixon: All those who think the use of selenium decolorizer is injurious to the tank blocks are as yet unable to tell just what causes it.

[1] Presented before the Glass Division, Atlantic City Meeting, Feb., 1924.

In a number of cases the blocks in the furnace are damaged and worn away much more rapidly than they were in the same furnaces when they use manganese as a decolorizer. It is a strange thing too that in many instances the front walls of the melting chamber and the bridge wall are worn away more rapidly than the filling end next to the dog house. This is almost a reversal of the conditions existing before.

If a tank is working properly the glass near the bridge has become almost perfectly plain. The fusing and clarifying of the materials has occurred before it reaches that point so that next to the bridge or on the front end of the melting chamber there is a body of glass that is very transparent. We know the heat rays penetrate glass as does light, in proportion to its transparency. Naturally, therefore, without any color in the selenium glass and being more transparent than when manganese was used, some think that the intense heat penetrating the glass to a greater depth is the cause of more rapid erosion.

There is another theory. As furnace builders we get orders for furnaces of capacities from 12 to 75 tons of glass a day. We find that in nearly every case, after operating a year or little more, they have exceeded the rated capacity of the furnace. That has resulted naturally in the last few years from the use of improved feeders and automatic machines. Their calculations of capacity were based upon what they were able to accomplish with the unimproved machines. The productiveness of these machines have increased 25 to 30% since the furnace and the machines were installed. How do they meet that condition? They must increase the melting. They must run the furnace hotter. Consequently they have gotten into the habit of running their temperatures very much higher than previously.

These are a few conclusions reached not only from my own observations but also from the discussion of others who have not technical knowledge of the subject but who are simply up against the practical proposition almost every day. If there is any theory, any scientific solution of this, we should like to know it.

Dr. Shively: In recent years, unquestionably the tank builder has improved the efficiency of his tanks. Today it is nothing uncommon to find an actual temperature of 2800°; 2750° seems to be the average. I know of a number of tanks that never run less than 2650°. This high temperature has its influence on the tank block. I know of one particular case where a tank was in operation for 11 weeks at a temperature of 2750°. Mr. Dixon rebuilt this tank from the same blocks. On the advice of the technical men it was run at 2650° for the next fire and lasted 12 months. The temperature condition has a great deal to do with the blocks wearing away.

I know of furnaces in operation that are pulling as much as a ton of glass

on 7 square feet and in some cases they are pulling more than that. The old tank rating was a ton of glass to 12 square feet.

Another thing that has an influence on selenium glass is that today we are getting soda ash that analyzes about 99.6% sodium carbonate. It is a granular ash. It is my belief that polymerization losses in this granular ash are practically nothing. You cannot find any loss by an analysis of ash which is carefully put into the batch. The Lime Association has been working to supply burned lime having ignition loss of around 2%. This means that you are now getting more flux into your glass.

There is a tendency to increase the soda content in order to pull more glass. In machine operation they are pulling the tank six days in a week and usually pulling it hard. In the old hand operation, unless they were working three shifts, the tank stood still for 5 or 6 hours during the day, and when it was started up again the direction of the channel of the glass was changed. Erosion has a great deal to do with wearing the blocks away.

Mr. Dixon has advanced a theory in regard to heat and light transmission. A piece of molten green glass without any decolorizer in it is just as transparent as a piece of selenium glass. Manganese glass, of course, is not transparent but the green glass is. In the old days they considered that the green glass tank would last longer than a manganese tank.

On the other hand, I hear a great deal of complaint regarding manganese pots. They are using manganese pots right along.

The glass manufacturer is anxious to increase his production. He goes to the block manufacturer because of shorter time life. Selenium is the only new thing introduced hence they pass the buck to selenium. They do not consider that in using selenium the resulting saving is approximately a dollar a ton on the glass melted. In a 25-ton tank in 8 months, enough will be saved over the cost of using manganese to rebuild that tank.

The results being obtained must be considered. The tank glass today is better than the pot glass ten years ago. A lot of the contention in regard to selenium being hard on tanks can be attributed to other sources.

Dr. Silverman: I have had no experience with the effect of selenium on tanks but I have made selenium ruby glasses in pots. We use from 8 ounces to a pound and a half of selenium per hundred of sand. The pots have lasted anywhere from 22 to 40 weeks. In some cases the pots lasted 50 weeks continuously on selenium ruby. There was no excessive corrosion. So far as that experience is concerned, it would hardly seem to imply that the selenium is responsible for very serious corrosion.

Mr. Payne: Were these covered pots?

Dr. Silverman: Yes.

Mr. Dixon: In tanks making colored glasses such as blue, amber and green glass, it is well known that they will last longer than any tanks making flint glass. I do not believe that the fluxes in the flint glass are any

more detrimental to the blocks than the fluxes used in the green, amber and blue glass. Practically the only difference is in the color and the transparency. The tanks making that kind of glass last much longer than the others.

I did not say I thought there was anything in the selenium that would injure the block. I said it was probably due to the heat transmission because of the transparency of the glass which is more transparent than the glass made with manganese. In regard to our experience in using the same sort of lime batch, it used to make our tank blocks show much less pitting after we added selenium to the same fundamental batch.

Dr. Littleton: I do not have enough information to argue the heat transmission of molten glass. We do know that there is not more than 10% of the visible radiation at those temperatures. The rest of it is non-visible radiation, and while a glass may be much more transparent to that 10%, it can easily be much more opaque to the rest of it. We have glasses which are perfectly opaque to the visible and yet transmit, in a solid condition, a very high percentage of the infra red. Compared to some of the transparent glasses, the reverse is true. There is some evidence which indicates that glass is more transparent to the infra red in the molten condition than it is in the solid condition, but it is mere circumstantial evidence. There is nothing positive to indicate it. It would be rather surprising, from a theoretical standpoint, if it were more transparent to the infra red in a molten condition than it is in the solid condition.

Dr. Shively: A manufacturer who is pulling 18 or 19 tons on a 12-ton tank with green glass machines advises me that they do not get the life of tanks they formerly got when pulling 12 tons. Some of these green glasses are so stiff in the bottom that they frequently have to insulate the neck, not particularly in this country but in England, in order to get the glass through.

The life of a tank could be increased if the manufacturer knew a little bit more about how to heat up his tank. The clay people ought to know this. They have been a little lax in not giving advice to the glass manufacturer in regard to bringing up his tank. With the tank full of glass the fires downstairs are lighted. When 500 or 600° is obtained the fires upstairs are lighted. I have seen tanks brought up in a week to 2550°. Every block in a week would be honeycombed; just cracked to pieces.

A case in point may be interesting. A certain factory operates large tanks with 8-inch blocks. Two years ago they were getting 19 months out of their tanks with selenium. He said about that time they introduced the double mold and increased the capacity of their tanks from 30 to 50 tons, and likewise increased the temperature 200°. They are now getting 12 months out of the same tank. I think that illustrates what heat and tonnage do to the life of tanks.

Mr. Ross: I believe that careful observation of the amount and kind of batch filled into tanks and the temperatures of operation will lead to considerable information concerning the properties of tank blocks.

Mr. Flint: How can we make any more observations than we do with a recording pyrometer on temperature and an absolute knowledge of the number of pounds of batch that go in, and checking with an optical pyrometer the heats at the various locations in the tank?

Mr. Payne: In an amber tank, which we were heating up, the entire bridge wall was criss-crossed with large cracks almost large enough to put one's finger into. Probably there was hardly a space on that bridge wall that did not have one or more of those cracks across it. That tank lasted 33 months yet the bridge wall was absolutely full of cracks. It was our opinion that if the bridge walls cracked in that manner they would go out in a hurry. We have had tanks which did not have those cracks. Some of these lasted well and others went out even faster than those which started with the cracks. It seemed to make very little difference whether or not those cracks were present.

Mr. Flint: What is the idea of drilling a hole in the block when the blocks have a hard enough time as it is. The best thing to do if we want to see what is happening to the block is to build it out of glass.

We have a heating schedule from 11 to 12 days. Generally with a recording pyrometer, it is a straight line heating increment from room temperature up to 2500 or 2600° with the exception of a drop of 100° when we change from the burners inside to the port burners. That schedule was adopted to give uniform heating conditions. Many tank block men were shocked because it took less than 25 days to heat up a tank. My first reaction was, if the men who make tank blocks do not agree better as to how long it should take to heat up, how will the glass maker be able to decide. Some say you really ought to use only 12-inch blocks, that is 12 x 12 or 24 x 36. They burn so much easier. Another one will advise the use of 30 x 36 so as to have less joints. There does not seem to be any unanimity of opinion about such things. And they really are fundamental.

One tank block salesman will see a block he knows to be his competitor's and say, "Do you buy blocks like that with cracks all over them?" And another says, "Yes, they have a few cracks but it does not amount to much." How can we get blocks that are uniformly well manufactured?

Very recently some blocks were delivered to one of our factories in Zanesville. They were odd-shaped blocks, the back end of a flow spout. The cross section of them looked like a U. They had sat in the middle of the freight car and just the jolting of that freight car was sufficient to cause the sides of that U to drop off. It left the imprint of the man's finger marks where he had to put it together. When that block is heated and cooled in use something is going to happen to it. All our blocks are not

like that, but enough of them are so that we wonder just to what extent some of the manufacturers are keeping after those little things. We realize that the man who worries and thinks about that the most is not putting that block together. The thing that makes that a success is the matter of superintendency and foremanship. Users of those blocks do not have a thing to do with this superintendency or foremanship but they have to take that block and take the consequences.

This subject has very recently been so strongly brought to attention. I looked up the records back to 1915. The tank life varied from 50 to 80 weeks in those days. Now it is about 20 weeks. By extrapolating, I calculate that in 1930, they will have no life at all. Our job is to stop this shortening of the life of the blocks before we get to 1930. A man I talked with recently stated that he does not use them any more. They did not last very well, so he began using ordinary 9-inch fire brick.

Mr. Finn: About 4 years ago in the Optical Glass Bureau we had a great many pot failures. Probably two pots out of three were in the habit of going through. Recently we changed our firing schedule making it slower in the beginning and finished at a higher temperature. This makes a longer schedule. The difference in the quality of the pots was so very marked that I am sure the manufacturer or the ultimate consumer of tank blocks would be justified in higher firing for his blocks.

A very significant point along that line is the use of these pots for the melting of a dense barium crown. Dense barium crown is regarded as probably the most corrosive glass made. I cannot say that it is more corrosive than a very dense lead (75% lead oxide) melt.

I was asked at what temperature I was going to run this barium crown. He said, "I would like to see some of the glass out of that pot. You will never get it out of the furnace." When we took it out of the furnace according to schedule the pot showed practically no signs of corrosion.

From a chemical point of view, lead oxide is one of the best solvents for refractory materials. I have had occasion to make but two or three melts of dense lead glass, but I may say that it took all the nerve I had to put a 75% lead oxide batch into a pot. I put it in, melted it, took it out, broke the pot, and the evidence of corrosion was very slight. We attribute that more to the firing treatment of the pot and the ultimate temperature of firing than to the quality of the materials. We have changed the pot batch quite a little bit to see what could be done. Within reasonable limits pots can be made of most anything if they are properly fired. I would like to urge that somebody making tank blocks try the effect of firing the pots up to that temperature at which they begin to lose their shape under their own weight. We hold them at these temperatures for about 8 hours and find we have a very wonderful pot.

Mr. Flint: We have very seriously talked with almost every tank block manufacturer about firing to high temperatures. Some of them say, "yes, it would be very interesting." Others will say, "No, it is absolutely unnecessary and useless time, labor and fuel to spend to do it." Others will say, "Some time we hope to do it." All of these men apparently have very thoroughly and seriously considered their own product. Part of the argument which they give against firing a block to 2600 or 2700° or even more, is that in the tanks they do not get to that heat. They say that not over 2 inches of the top rim which is above the surface of the glass and facing inside the tank gets to that heat.

Mr. Brownlee: We fired 4 different batches of blocks at 2750°C. With these we built an experimental tank at the Owens Bottle Plant, and we ran a test for 6 weeks. The large tank had to be let out at the end of this 6 weeks hence naturally this experimental tank had to be cut off. We then enlarged the tank. We built it up with fire brick in three places exposing the fire brick to the glass. On letting the tank out we found that there was a slight wearing of the tank blocks, but there was no more wear shown on the tank block than there was on the fire brick. The fire brick was just flush with the tank wall. This experiment was not carried to completion. I think it is a very good idea firing the block higher. We are now firing our blocks to 2550°.

Mr. Flint: Did you use pyrometers or cones?

Mr. Brownlee: Both.

I feel that the smaller the block is, the much easier to fire. The heat goes all the way through the block where it would not on a large block.

Mr. Montgomery: It seems as if one point has been missed in this tank block discussion, and that is the composition of the tank block. In optical glass manufacture, which includes everything from the ordinary soda-lime glass, which is not markedly corrosive, to the glasses of high barium and lead content referred to by Mr. Finn, we have to develop a pot which will suit each particular glass. The pot should mature and have the proper physical properties at the temperature at which the melt is to be made. A pot which will give satisfactory service at 2550 to 2600°F will seldom give equal service at 2650 to 2700°F. The composition of the pot will have to be changed to give the required properties at the higher temperature.

We melt some of our barium glasses at 2300 to 2350°F. It was necessary to develop a pot which would mature at this temperature or fire the pot to the temperature at which the necessary physical properties were developed. We fired the pots, used for this glass, at 2550°F.

If a very fluid glass like the densest barium glass is melted in an underfired or porous pot, it will run through the pot like water through a sponge. The glass will penetrate the pore space and seep out into the furnace. If

the same pot is fired to the point where it is dense, this filtration or seepage will be stopped. The point illustrated by this extreme case will apply to all pot making. The manufacturers of glass house refractories often do not realize the variety of conditions their products are called upon to meet. They do not suit their batch composition to these conditions. A commercial batch is expected to answer all purposes. This will never be satisfactory. The pot manufacturer must specialize more before much headway will be made.

Mr. Merritt: I have had no practical experience with these blocks, but I recently made thermal expansion tests on clays. The shape of the thermal expansion curve changes very definitely with the intensity of firing. The results obtained confirm Mr. Flint's statement that if a block or any clay material is to be used at a certain temperature it should be fired to that temperature and perhaps a little higher.

Mr. Flint: We have a couple of tanks, the blocks for which we would like to have fired to 2750°. Would it be possible to get such blocks?

Mr. Brownlee: I believe the clay would stand it. It would be more expensive, but I think in a smaller block it would be possible.

Mr. Flint: Could it be done commercially with the present type of kilns you are using?

Mr. Brownlee: Yes.

We fired the blocks that I mentioned in that experiment in a special small kiln. We would like to try it.

Mr. Flint: You will have the chance.

Mr. Fulton: I do not believe that the majority of block makers' equipment for firing tank blocks would stand any such temperature. In fact very few of them are in a position to fire to 2750° without constructing a special kiln for the purpose.

Mr. Dixon: Mr. Brownlee is right in his theory of a smaller, thinner block. If any of you have had occasion to cut some of the large blocks in half you have noticed that in the larger block, the center is often almost as black as coal. This indicates that the block was not thoroughly dry before it was fired and that in the firing they forgot that all that moisture in the middle of the block had to be driven out. This discoloration in the block is something I do not understand. It has been proved time and again however, that it is due to the moisture left in the block before it is put in the kiln. If the blocks could be fired thoroughly all the way through at about the temperatures to which they are later submitted, it seems to me that they would stand up much better. Sometimes you find in the wall of a tank one or two blocks that have peculiarly stood the test they were put to, much better than all the adjoining blocks, and nine times out of ten it is a block that is well fired.

Consider the conditions to which a 12-inch block in the wall of a tank is

subjected. It has not only the corrosion of the metal on the inside, but it has the higher temperature on the inside and is cool on the outside. Is not that liable to break the structure of the block? We have just heard about the expansion and contraction of the clay. This difference in temperature is bound to break the structure. The block will not stand the heat when it is insulated.

A few years ago Mr. McNeelye, from Australia, told me that during the war they could not get tank blocks for reconstruction of their tanks. They had to go out of business for a while. Finally they discovered a bed of sandstone which they thought might serve the purpose. They cut the sandstone into blocks. These sandstone blocks outlasted any clay blocks they had had. The stone was very close grained soft sandstone. It could be cut with a saw. It hardened as it got dry, but it did not seem there was any particular quality in that stone that would make it last longer than clay blocks.

The Old Dominion Glass Company had two tanks in operation built of silica brick. They generally lasted two years before needing repairs. These furnaces were like big canal boats. They had a crude sort of producer on one side and a port leading directly into the tank. They did not have a bridge; simply boots deep enough to skim the glass. The brick stood up in that stew pot, as I called it, for more than two years.

They were so impressed with the idea that silica brick were better than clay tank blocks that they insisted on the use of silica brick in their modern furnaces. We took the precaution to build the furnace such a way that the silica brick could be easily removed and clay blocks substituted. We built a furnace that ran much higher in temperature than the old furnace. Five weeks after it was started, I got a telegram to hurry a set of clay blocks to them. The silica brick had melted away and were almost all gone.

The block people are constantly trying to improve their products. All of them recognize what they are up against. They are required to meet conditions now that never existed before in all their experience. They have nothing with which to make blocks except the raw material in the ground. All they can do is to improve their treatment and improve their methods of making blocks. The service which tank blocks have to give today is twice as much as they formerly had to give.

Mr. Ross: If we fire blocks as dense as a pot that has been in service a few weeks, is it not probable that we shall have to give very careful attention to the thermal strains set up during heating and in use?

Mr. Yung: No tank is stronger than its weakest point. It may be the life of the water cooler, but not the life of the blocks that determines the life of the tank. What do we mean by the life of a tank?

The heating schedule seems to me to be of most importance in tank operation. The expansion of a clay block or of a silica brick is not the same

throughout the entire range of heat treatment and vitrification. There are two points which are the most delicate. The first is the water smoking period, so called. It is a matter of safety that the lag between the temperature of the block and the temperature of the furnace has to be carefully overcome. This water smoking period is from the start of the fires up to 300°C. The second critical stage is from 500 to 600°C. This is the temperature of dehydration and oxidation. Beginning here also is the breaking down of the clay molecule.

The point I wish to bring out is that a straight line preheating schedule may or may not be a good practice. The practice I have adopted is to run from atmospheric temperature to 300°C at a rise of $2^1/_2$°C per hour, and from there on up to melting temperature at the rate of 10 to 12°C per hour.

Another important thing is the firing the clay pots and block at highest possible temperature. Also of importance is the method of filling the tank while heating up. The schedule I have adopted includes a two day soaking heat at the highest temperature. That soaking heat is the maximum temperature that the furnace will stand—perhaps, in the neighborhood of 1500 and 1550°C. This seems to have a marked effect upon the lasting qualities of the tank.

At the start the glass is put into the tank for glazing purposes. It is banked up against the side, and the total bulk of cullet put in is only sufficient to cover the side wall. When melted it amounts to about 2 inches on the bottom. Another method I have seen used is to shovel in the cullet in a uniform layer practically filling the tank. There is a marked difference in the corrosion by the two procedures. With the cullet filled to the metal line the joint between the first and second course gets a very light firing and I think this is the cause for increased corrosion at the joint.

Mr. Williams: We should decide to bring in enough discussion or information to next year's meeting to decide two points. The first point regarding tank blocks is, what percentage of the loss or wearing away of the tank block is corrosion and what percentage is erosion. The next point is that which Mr. Yung has just emphasized *viz.*, what are the relative kinds of results, or the type of result, the finished result, from different methods of heating up the tank in the beginning. That seems to me to be very important. If Mr. Yung's observations hold generally it is very important. Indeed, it seems to me that 90% of the loss of our tanks is due to corrosion or to the lack of refractoriness, and 10% to erosion. If this is true we should immediately begin to consider refractoriness of the blocks of prime importance.

I suggest that whoever has charge of the program next year should remind the members of the Division that we would like to have all the information possible about these two subjects. Refractories to the glass maker

means a great many dollars and cents, and it would be worth while continuing these discussions, but let us bring them down to a couple of definite points and not range all over the many defects.

Further Discussion on Selenium

By R. R. Shively

I have listened with interest to the discussion of this subject by the previous speakers. Having used selenium for a number of years, I have given consideration to possibly every phase of its use and have at last decided that there is no one thing that one can say is the cause of the tank blocks not lasting as they formerly did. It is my opinion that there has been a decided improvement in the tank furnaces during the past few years. The furnaces now being built are capable of higher temperatures and my experience leads me to believe that practically all glass manufacturers are inclined to play safe and run the tank as hot as it can be run. In several instances the actual temperature being carried is close to 2800°F and at present there is no refractory that will withstand this temperature over a long period.

I know of one instance where a tank was operating at a temperature of 2750° and only lasted eleven weeks. This same tank was rebuilt with blocks from the same manufacturer and operated over a period of twelve months at a temperature of 2550°. You might be interested to know in this particular case that they were able to get as much tonnage at 2550° as they had previously secured at the higher temperature. Of course in this instance it means that the tank was not being pulled up to capacity at the higher temperature.

With reference to this particular phase of the subject, I recently had a letter from the superintendent of a very large factory who informed me that up until two years ago, the life of their tanks averaged eighteen to nineteen months, but since that time they had increased the pull on the tanks from thirty to fifty tons in 24 hours and in order to do this, it was necessary to increase the temperature 200°, and as a result the life of the tanks was reduced to twelve months. Just within the past few days, I have talked with a very prominent manufacturer who claims that he does not now get the life out of tanks which he formerly got on manganese, but in this discussion he told me of the wonderful improvement in his tanks and of the high temperature which he could now obtain.

Within the past four or five years, there has been a very decided improvement in the heavy chemicals supplied to the glass manufacturer. Today, at least some of the soda ash manufacturers are supplying soda ash that analyzes not less than 99.5% sodium carbonate and this is being fur-

nished in granular form in which all of the fines have been screened out, and it is my belief that this has greatly reduced the volatilization losses of soda, which together with a greater purity being supplied, increases materially the soda content in the finished glass.

The high alkali glasses have undoubtedly more fluxing action than those containing a lower percentage of alkali. Due to the educational work of the National Lime Association, burned lime is now being supplied which has an ignition loss of only approximately 2%. This means that the manufacturers are getting more lime in their glass and this too may have its influence on the rapid fluxing of the blocks. Unquestionably all of the members of this Division realize that in the past few years, practically all of the manufacturers have introduced mechanical feeders and machines for shaping the glass. The results have been that the pull on the tanks has been increased and the tanks are now operating six days a week without any stops, consequently there is a constant drag in the walls and I do not believe it can be disputed that erosion has considerable to do with the wearing out of the blocks. When the tanks were worked by hand, there was always a stop in the morning from two to seven which permitted the glass to plain and which always gave an opportunity to change the direction of the pull. There seems to be an over production of glass at the present time and competition is very keen. Labor costs are high, chemicals are high, fuel is more expensive and yet the finished ware is selling at reduced prices. The results have been that the manufacturers have tried to overcome these conditions by increasing their production and in order to do this, they have resorted to higher temperatures and in some cases, more soda and naturally the life of their tanks has been reduced.

Recently an old glass manufacturer remarked to me that better looking tank glass is now being made than the pot glass which was produced ten years ago. The results being obtained are really beyond belief. When this is taken into consideration along with the fact that the saving in the use of selenium amounts to not less than one dollar a ton on the glass melted, it can be readily seen that on a twenty-five ton tank, operating for eight months, the savings will be sufficient to rebuild the tank.

On account of the superior results obtained with selenium and this saving, I do not anticipate that many manufacturers will go back to the manganese even if its use could be proven to give longer life to tanks which I doubt would be found the case under present operating conditions.

If you will please excuse the common parlance, I do not want to be understood to be "passing the buck" to the block manufacturers, but I believe that if they would take more interest in educating the user of their product as to the correct way to bring up the tanks, better life would be obtained from the blocks.

In summarizing these remarks, it impresses me as a round robin proposition. The glass manufacturer has appealed to the tank builder because his tank does not last, the builder in turn blames the block and the block manufacturer attacks selenium because it is the only new substance generally used in glass. Selenium has served the manufacturer well at a time when it was badly needed and unless I am grievously misinformed, the results obtained and its monetary savings shown, justify its continued use.

It is impossible to determine the amount of selenium actually necessary for decolorization. The average amount used in the batch is less than one part in 80,000 parts of finished glass and as some of this is lost by volatilization or oxidation, it is quite impossible to find by analysis the amount of selenium remaining in the finished glass.

A few manufacturers do not use arsenic and the amount of selenium required for their batch is unusually small. I know of one factory where raw materials of low iron content are used, that requires but .125 ounces of selenium combined as a selenite, to decolorize a thousand pounds of sand. Another factory not using arsenic, but using the element, requires but .25 ounces of selenium for a thousand pounds of sand. Where the average amount of arsenic is used, two pounds to the thousand of sand, the amount of selenium required to the batch is about .4 of an ounce. Where a selenite is used, even a smaller quantity is required. It can be seen from the above facts, that very little selenium is required for decolorization, and if any unusual amount of it is lost through furnace conditions, it would seriously affect the color.

As to the properties of selenium, it melts at 217 °C, it burns in the air with a bluish red flame, forming selenium dioxide, and boils at 690 °C. From these properties it would be expected that some of the selenium introduced in the furnace is lost by volatilization, and in the case of a tank operating under oxidizing conditions, some of the selenium may combine with oxygen and the selenium dioxide carried out with the stack gases.

Let us consider for the time, ruby glass, where a much larger amount of selenium is used. Ruby batches made in pots require much less selenium than those made in day tanks. In the latter case, I am informed that everything depends upon the flame—a certain batch may give a good glass one day, and the next melt may be unfit for use. The fumes of selenium can be seen escaping from these tanks. If, where larger amounts of selenium are used, the operation of the furnace is so important, it certainly has its influence in a lesser degree where small quantities are employed.

It has been my experience that the hotter the tank is run, the less selenium is required for decolorization. This may be explained by the

fact that where high temperatures are obtained, the furnace is being operated efficiently and a neutral condition is maintained within the furnace.

Unquestionably tank conditions affect selenium decolorization. Constant temperatures and uniform furnace conditions must be maintained in order to get the best results.

WASHINGTON, PA.

DISCUSSION ON "STUDIES OF THE THERMAL CONDUCTIVITIES OF SOME REFRACTORY MATERIALS"[1]

J. SPOTTS MCDOWELL: In this paper, the mean conductivity between 650° and 1250°C is given as follows:

Silica brick.....	0.00099
First quality fire-clay brick....	0.00169

The conductivity of silica brick therefore appears to be about 58% that of fire-clay brick.

O. T. Green[2] found the conductivity of silica brick to be about 80% that of fire brick. Other investigators, including Boyd Dudley[3] and Goerens and Gillis,[4] report it to be 15 to 25% higher than that of fire brick.

In this connection, it is well to refer to the fact pointed out by W. A. Hull[5] that the conductivity of the refractory is only one of several factors working in series which determine the amount of heat flowing through a wall. Other factors are the "diffusivity," the effects of joints and surface resistance, of the luminosity of the flame, draft conditions, whether positive or negative, absorption by the refractories of material from the gases, and glazing or vitrification of the hot surface of the brick.

In furnace practice it is known that more heat will pass through a silica wall than through one of fire-clay brick of equal thickness. The use of silica brick in by-product coke ovens has shortened the coking time. In a paper by F. A. J. Fitzgerald,[6] some interesting figures are given. Furnaces were constructed of hollow cubes with external sides of 230 mm. and walls 60 mm. thick. The furnaces were supported on knife edges so that all sides were exposed to the air, and were heated by nichrome resistance

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[1] *Jour. Amer. Ceram. Soc.*, **7** [1], 19(1924).

[2] "The Thermal Conductivity of Refractory Materials at High Temperatures," *Trans. Cer. Soc.* (Brit.), **21**, 394(1921–22).

[3] *Trans. Am. Electro-Chem. Soc.*, **27**, 336(1915).

[4] *Ferrum*, **12**, 1, 17(1914).

[5] W. A. Hull, "Thermal Conductivity of Refractories," *Chem. Met. Eng.*, **27**, 538 (1922).

[6] *Trans. Amer. Electro-Chem. Soc.*, **22**, 110(1912).

wires. The following figures represent the amount of energy required to maintain constant temperature conditions within the furnace.

	Watts lost through walls, temperature °C		
	500°	700°	800°
Fire brick	475 w.	770 w.	930 w.
Silica brick	565	920	1100
Magnesia brick	860		

	Ratios: Heat lost, temperatures °C		
	500°	700°	800°
Fire brick	1.00	1.00	1.00
Silica brick	1.19	1.19	1.18
Magnesia brick	1.81	....	....

Another way of comparing these results is as follows:

With a power input of 860 watts, the following temperatures could be maintained in the furnace:

Magnesia Lining.....	500°C
Silica brick lining, about.....	670°C
Fire brick, about.....	755°C

DEFINITION OF THE TERM CERAMICS AND PROPOSAL OF INTERNATIONAL STANDARDS

Rudolf Barta (Dr. Ing.):[1] The Czechoslovak Ceramic Society sent its delegates to the International Congress for Applied Chemistry in Copenhagen, Denmark. I shall mention the point of view which we have in respect to the treating of the Ceramic Division:

1. Name "Ceramic"

The Czechoslovak ceramists are well informed of the suggestion of the commission of the American Ceramic Society that the name "Ceramic" may be used also in other branches than clay working.

This proposal follows the aim of simplifying the denomination for relative branches of industry. This proposal has however met with certain difficulties:

(1) The way of production in cement, lime, glass and enamel branches rather differs from that of clay working.

(2) The denominations of cement, lime, glass, enamel, etc., are in general use, and by them are directed the international contracts, railway-tariffs, custom-tariffs, statistics, etc.

(3) The introducing of the American proposal would cause changes in the international relations correspondence and record. It may even cause chaos, and a certain chaos in business connections.

If there is the endeavor to introduce a common denomination for the branches of clay working, cement, lime, glass, enamel, etc., then according to our opinion it would be better to choose quite a new denomination. After the proposal of Prof. Dr. Ing. O. Kallauner, it would be for instance "silicates and the respective branches," or abbreviated "silicates"—as it is already in use in Czechoslovakia. Perhaps another more suitable denomination will be found.

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[1] General Secretary of the Czechoslovak Ceramic Society.

2. Nomenclature

The Czechoslovak Ceramic Society welcomes the proposal that in all countries commissions be appointed for standardizing ceramic nomenclature. These commissions should be in connection with the international one, in order to effect unity.

3. Designations of Types and Specifications

Czechoslovak Ceramic Society consents in principle that the types of ceramic raw materials may be fixed. It will have a considerable importance in furthering scientific research.

For the international types the Czechoslovaks recommend of their raw materials the china-clay of Sedlice (Zettlizer kaolin) and blue clay of Vildstajn (Wildsteiner Blauton). Both are of equal quality, well known in the world, and a whole series of scientific experiments was made with them.

Besides we beg to recommend that types of local importance be fixed in every respective country.

4. Technological Works

Messrs. Le Chatelier and Lapsa have proposed to compile a certain number of works on ceramic technology. This in Czechoslovakia is not considered as pressing. We beg to draw your attention to some works done in the United States.

For instance, works on chemical analysis of silicates could scarcely be made better than those of Hillebrand, etc.

5. Proposals of Czechoslovak Ceramic Society

To the international conference in Copenhagen the Czechoslovak Ceramic Society has sent these four proposals:

(*a*) Make the comparative experiments between the tests in laboratories and tests in practice.

It is known that the tests on specimens formed in laboratories give different results from tests executed by the same methods on the same raw materials in practice.

Such comparative tests have already been introduced by the Czechoslovak Ceramic Society. The head-man of these investigations is Prof. Dr. Ing. O. Kallauner.

(*b*) It would be advisable to make the international unification of ceramic testing.

(*c*) The elaborating of an International Ceramic Chart would be of significance. It should contain the chief deposits of ceramic raw materials and the chief factories. A list with explanations should accompany.

(*d*) By noting of the ceramic formulae it is recommended to state not only the chemical and rational composition, but also the analysis of grain size, etc. These would make the descriptions of one meaning.

Dr. E. W. Washburn:[1] I have read the recommendations of Dr. Barta. I believe his suggestions and comments, under Nos. 2, 3, 4 and 5, are excellent and well taken.

With regard to No. 1: His principal objection to the definition of the term "Ceramic" is based upon the difficulty which would be caused in business relations. This objection was brought up and thoroughly discussed at the meeting of the Committee of the International Union which passed upon the question and because of this difficulty the Committee voted to approve the definition *for scientific and technical purposes only,* not for business or trade purposes. With this limitation on the definition the objections of Dr. Barta no longer hold.

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[1] Recd. July 21, 1914.

REFRACTORIES QUESTION BOX[1]

E. E. Ayars, Editor

Questions

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire clay to spalling?

2. What difference is there between the properties of a soft mud machine made and a hand-made brick?

3. Can an iron-free clay brick be made for blast furnace service?

4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?

5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?

6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand-made fire brick?

7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?

8. What is the reason for the more rapid failure at a lower temperature of fire brick subjected to reducing atmosphere than will obtain with the same brick under oxidizing conditions?

9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

10. At what temperature does fire clay break down into sillimanite and quartz? Are the crystals thus formed actual sillimanite or are they the newly discovered mineral $3Al_2O_3$-$2SiO_2$?

11. What properties should a clay brick possess to give good service in rotary cement kilns?

12. What properties should a clay brick possess to give good service in vertical shaft lime kilns?

13. How can the water content for wet pan charges be gaged?

14. What simple laboratory tests can be used to keep the quality of refractories up to standard?

Question

How can the water content for wet pan charges be gaged?

Discussion

The following extract is taken from a paper, "How Good Silica Brick are Made," published in *Brick and Clay Record*, October 16th (1923).

"European silica brick manufacturers have realized the importance of standard grinding practices and much has been done to develop methods of scientific control. The grinding is usually done in medium sized wet pans driven by individual motors. The motors are severally connected with recording ammeters which have charts in plain view of the pan oper-

[1] See note, *Bull. Amer. Ceram. Soc.*, **3** [7], 258(1924).

ator at all times. By experimental runs the desired size of grain, quantity of water and length of run was determined. The ammeter record charted the course of each grind and a standard chart was adopted for daily use. This method insures uniform grinding and tempering results. In one case the first five minutes of the cycle is consumed in dry grinding,.... The reduction in amperage is very noticeable when water is added and when the recorder pen recedes to a certain specified point the water is turned off. The grind then continues about fifteen minutes until at a predetermined point in the cycle the pan is emptied and a new dry batch of material added. Very accurate results should be obtained with this method. By referring to the ammeter chart one may note the relative power consumption of an empty pan and of both the wet and dry grinds."

It appears that the method described for silica brick can be easily adapted to the tempering of fire clays, although another means of indicating the power consumption of the individual pan would have to be devised in the case of line shaft drives. Such an indicator could be developed by a good instrument maker.

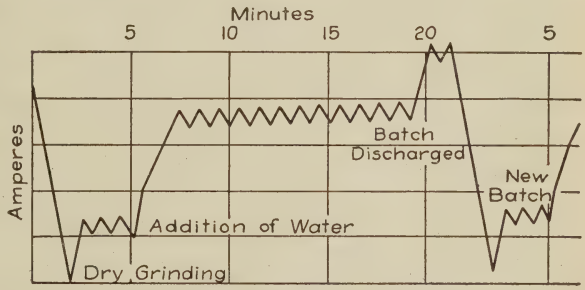


Fig. 1.—Ammeter chart used in European works to provide uniform grinding and wet pan tempering of silica brick mixtures. A 20-minute cycle is used which was determined by experiment to give the results required. Can be adapted to wet pan tempering of fire clay mixtures.

This method automatically takes care of the variations in the moisture content of clay from the storage pile or mine, a problem which has precluded the possibility of obtaining uniform results by weighing the charge and the water to be added.

It has been established that concrete mixtures should contain just enough water to wet the material through thoroughly, and tests have been developed to check the consistency of the mass. The "Slump Test" as applied to concrete consists in filling a conical cylinder with the mixture and striking the excess material from the bottom of the inverted cylinder. Placing the cone on a board the metal shell is removed and set down beside the test piece. By placing a rule across the top of the mold and measuring down to the top of the test piece the amount of settle is determined, and this indicates whether or not the mixture has the proper amount of water in it.

A similar test might be developed for testing the consistency of clay from the wet pan. However the fact that clay is plastic and not liable to settle

enough to form a basis of judgment it would be necessary to use some sort of apparatus to exert pressure on the test piece.

The Vicat needle may suggest a possible test.

However the use of such tests as this takes more or less time and probably would not operate within fine enough limits to be of as much value as the recording indicator as used in Europe.—Ed.

Question

What simple laboratory tests can be used to keep the quality of refractories up to standard?

Discussion

The simplest test and one which has a direct bearing on size of grain, water content and molding methods, as well as temperature and speed of drying, is the green brick modulus of rupture. The green brick modulus may be correlated with the burned brick modulus of rupture and other tests. Results recorded on daily tests which do not fall between certain well defined limits are known to have been taken on a product below standard.

Assuming that the chemical analyses of the various clays entering the brick mixture are correct and the proportions properly taken, one test which indicates the uniformity or lack of uniformity of the manufacturing treatment should be sufficient check on the quality of the product. The test should be taken at various specified intervals during the day.

The test suggested will also indicate variations in the proportions of clays in the mixture. For a more complete discussion refer to Question Box department for May and July "Laboratory Control in the Manufacture of Refractories," *Bull. Amer. Ceram. Soc.*, **3** [5], 162–168(1924), and **3** [7], 259–261(1924).—Ed.

With further reference to the discussion of the failure of fire brick checkers in oil-fired boiler furnaces which appeared in the August number Question Box, R. F. Ferguson of Bolivar, Pa., formerly with the Refractories Industrial Fellowship at Mellon Institute, has submitted the following information, which has at his request been written up by the editor. Conclusions drawn are by the editor. The study of refractories failures in oil-fired boilers has included analyses of the slags formed, to provide a basis for the solution of the problem. In such investigations the slags have invariably been found to contain high percentages of titania varying from 6 to 10 per cent. This is much in excess of the usual percentages found in fire brick, which seldom if ever exceed 2 per cent titania. Some samples examined also contained small percentages of vanadium in addition to the titania. Several check determinations were made in the laboratory before the analyses were accepted as the high titania content and

especially the presence of vanadium had not been reported in any previous investigation which had come to the notice of the chemist, or the client.

The source of the slag samples cannot be identified at this time and the condition of the refractories from which the slags were collected was not recorded at the time of analysis. The analyses of brick used were furnished as a part of the working data and for comparison with the slag analyses results. Samples of slag submitted were taken from different parts of the country and while the oils in use were not specified and no analyses furnished it seems fair to assume that several representative grades of oil from the various fields were used.

In this connection there has come to the editor's attention a report of some recent work by the Northern States Power Company, "The Effect of Coal Ash on Refractories" by J. J. Brennan.[1] It appears that fuel oil residue should bear a close relation to coal ash, and in the absence of any exact analyses of fuel oil residues the following discussion assumes that the compounds present are essentially the same as are found in coal ash.

The Northern States Power Company studied the effect of ash from nine different coals on fire brick. Test cones were made using 70% of 60-mesh ground fire brick and 30% of 60-mesh coal ash. Nine coals commonly used in power house work and 42 different brick were examined. Analyses of representative brick were made, and the complete analysis of each coal ash determined. Test cone mixtures for each brick were made with each of the nine coal ash samples. Careful fusion tests were run off and the results plotted. The information presented is very interesting.

A review of the coal ash analyses shows the following variations: Silica 38.70% to 55.01%; Alumina 21.76% to 30.75%; Titania and iron (reported together) 6.07% to 23.14% (five analyses showed 6.00 to 10.00% titania and iron, while the remaining four showed 15.67% to 23.14%); Lime 1.15% to 11.47%, the average being 6.04%; Magnesia 0.90% to 2.59%; Sulfur trioxide 0.57% to 7.06% the average being 3.71%; alkalies 1.08% to 3.48% (3 samples undetermined).

Fire brick analyses on 14 samples showed a silica content varying from 25.65% to 61.58%, alumina content from 34.60% to 70.51%, titania and iron from 0.32 to 5.70 (the average being 2.03%). More complete analysis of eight samples showed variations of lime from 0.33 to 0.61%, magnesia 0.26% to 2.91%, alkalies 0.45% to 1.55%.

After a hasty study of the charts on which the results with each set of cones were plotted the following conclusions are drawn by the Editor. First: That the coal ash containing high percentages of titania and iron were most destructive to fire brick. Second: That fire brick containing

[1] Published in June, 1924 issue of *Combustion*, Combustion Publishing Corporation, 43 Broad Street, New York.

high titania and iron were more readily attacked by the coal ash. Third: That fire brick having a high silica content are most susceptible to attack by the coal ash than those brick having an alumina content of 45 per cent or more. Fourth: That there are some inconsistant results which occur when the magnesia and lime contents of both brick and ash are high. In this case low fusion points were obtained where the high magnesia and lime of both substances crossed.

The brick showing the highest resistance to the effect of the ash in all cases has the following analysis; silica 25.65, alumina 70.51, titania and iron 1.90, lime .61, magnesia .49, alkalies .84, and this brick has been adopted as a standard lining.

The author of the article cited above stated that the problem was not one "in which chemical quantities can be assumed, and no attempt is made to impose a theory to indicate, from a purely chemical standpoint, the effect of coal ash of fire brick." In his summary he states that "the actual performance of a number of brick tested has been observed during the past two years and in a majority of cases the actual life of furnace linings follows very closely the indications given in the chart."

However the data presented would permit of more careful study. The same procedure may be extended to fuel oil residues where without doubt much the same results will be encountered. The Northern States Power Company used this method to select the best brick for their purpose but there is a great deal of information in the results which has not been interpreted, and it may be the foundation for which the industry has been looking, on which to build a perfect boiler refractory.—Ed.

Question

What is the fusion point and specific gravity of tridymite? Of cristobalite?

	Tridymite	Cristobalite
Fusion point	1670°C (Searle)	1625°C (Searle)
Sp. G.	Artificial tridymite, 2.27 (Fenner)	Artificial cristobalite, 2.333 (Fenner)
	Natural tridymite, 2.28 (Mallard)	Natural cristobalite, 2.34 (Mallard)
		2.32 (Searle)

ACTIVITIES OF THE SOCIETY

NEW MEMBERS RECEIVED FROM JULY 15 TO AUGUST 15

PERSONAL

Bramhall, Riley, Holmesfield, Sheffield, England, Works Manager, Moor Edge Silica Brick Works.

Carrie, G. M., Magnesite-Prov. Quebec, Canada, General Manager Scottish Canadian Magnesite Co., Ltd.

Corman, Julian, 1808 Walnut St., Murphysboro, Ill., Ceramist, Isco Bautz Silica Co.

Frazier, John Earl, Clarion, Pa., Chemical Engineer, Berney Bond Glass Co.

Le Heron, Revin (Ardennes), Director, Des Etablissements Porcher.

Lukens, Glenn, 502 E. Chapman St., Fullerton, Cal., Instructor.

Lyons, Sanford C., Bennington, Vermont, President, Vermont Kaolin Corp.

Simpson, Harold E., 87 Tibet Road, Columbus, Ohio, Student.

Weaver, Eduard E., 151 Alabama Ave., Providence, R. I.

Membership Workers' Record

	Personal
Howells Frechette	1
William Hugill	1
C. W. Parmelee	1
John Sawyer	1
Office	5
Total	9

THE SUMMER MEETING

Fred B. Ortman, general chairman of the 1924 Summer Meeting Committeew rites that the California members are looking forward to October 6 and 7 with great anticipation. They are doing more; they are making sure that the realization will equal the most exaggerated anticipations.

Two days' program of technical papers and plant visits followed by directed plant tours as those in attendance will choose are on the schedule of events.

Round trip tickets at excursion rates will be available. Ask your local railway agent for routes and rates with Hotel Biltmore, Los Angeles, Calif., October 6 and 7 as your objective.

RESEARCH COMMITTEE MEETING—ENAMEL DIVISION

(American Ceramic Society, Held at Hotel LaSalle, Chicago, Illinois, on July 7, 1924)

PRESENT—MEMBERS OF COMMITTEE

M. E. Manson,
Rundle Mfg. Co.

W. G. Lindemann,
Lindemann & Hoverson Co.

BY INVITATION:

P. H. Bates,
Bureau of Standards.

C. M. Pearson,
Pickands Brown & Co.

E. P. Poste,
Pfaudler Co., Elyria Division.
L. G. Wassman,
Wolff Manufacturing Co.
Homer F. Staley, Chairman,
Metal & Thermit Corporation.
J. A. DeCelle,
Chicago Hardware Foundry Co.
R. C. Boyd,
Chicago Hardware Foundry Co.
R. R. Danielson,
Lindemann & Hoverson Co.

Presiding Officer: R. R. Danielson, Chairman of Enamel Division.

The Chairman of the Committee gave a brief résumé of the chief research work to be undertaken this year. This is an investigation of the relations between the composition and structure of cast irons and their enameling properties. The Bureau of Standards has consented to do a large amount of research work on this problem with the advice and coöperation of the Enamel Division. The Metallurgical, Ceramic and Chemical Divisions of the Bureau will take part in the investigation.

After some discussion, it was decided that the first series of experiments should deal solely with the relations of structure in cast iron as effected by the percentage of scrap used in producing it and by the number of times the iron has been remelted, when the chemical composition is kept uniform. Other phases of the subject will be taken up later.

The following tentative program, subject to modification by the Bureau of Standards, was approved.

Cupola Melts

Series 1.—To find the effect of varying percentages of scrap in melts.

Melt 1.—100% Pig Iron. Part of this to be used in the following melts as scrap.

Melt 2.—20% Scrap
Melt 3.—40% Scrap
Melt 4.—50% Scrap
Melt 5.— 60% Scrap
Melt 6.— 70% Scrap
Melt 7.—100% Scrap

Series 2.—To determine the effect of repeated meltings on structure of iron. A certain amount of pig iron will be melted and test samples made. The remainder, with the addition of only enough raw pig iron to bring the composition back to that of the original mixture, will then be remelted in the same manner five or six times unless the iron becomes unworkable in a fewer number of melts.

Series 3.—Will be the same as Series 2 but with the use of soda compounds in the ladle to keep down as much as possible the gradual increase in sulfur due to remelting.

Composition Desired in all Castings:

Silicon	2.25 plus or minus 0.10
Sulfur	0.10 plus or minus 0.02
Phosphorous	0.65 plus or minus 0.05
Manganese	0.50 plus or minus 0.05

Coke.—Solvay coke containing 0.50–0.60 sulphur, ash 7–8%.

Cupola Practice.—To be kept as uniform as possible. $2^1/_2$% of high calcium limestone is to be used as flux.

Molding of Castings

Castings.—$3'' \times 6'' \times {}^3/_{16}''$. Cast four on a gate with the use of a spoon gate. Albany No. 1 sand to be used. No facing to be used. At least 50 castings to be made

from each melt. The method of molding and the pouring temperatures are to be kept as uniform as possible and the castings are to be allowed to cool in the mold until black.

Test Bars.—Standard foundry test bars are to be poured from each melt and subjected to the usual test for the determination of the mechanical properties of the iron.

Study of Castings

The Bureau of Standards will make complete metallographic and chemical studies, including determination of gas content, of representative castings from each heat. The results of these studies will be coördinated with similar studies of castings from the same heats after enameling and with the results of the enameling tests.

Enameling Tests

Enameling tests will be made in the Ceramic Division of the Bureau of Standards and also in the following plants:

Medium Temperature—Dry Coat

Wolff Manufacturing Co.
Direction of L. G. Wassman
Rundle Manufacturing Co.
Direction of M. E. Manson

Wet Coat Enameling with Use of Ground Coat

Lindemann & Hoverson Co.
Direction of R. R. Danielson

Low Temperature—Dry Coat

Chicago Hardware Foundry Co.
Direction of J. A. DeCelle

High Temperature—Dry Coat

Pfaudler Company—Elyria Division
Direction of E. P. Poste

Wet Coat Cast Iron without Use of Ground Coat

Porcelain Enamel & Mfg. Company
Direction of Karl Turk

All samples are to be cleaned by sand blasting just before enameling, are not to be annealed, are to be enameled on the drag side of the casting and are to be returned to the Bureau of Standards with detailed descriptions of methods employed in enameling. In all cases, commercial enamels are to be employed but the composition of the enamels used will not be divulged.

The Chairman of the Committee will visit the Bureau of Standards in the near future to discuss the details of this program and will advise the Committee members if there is any material modification to be made.

Yours very truly,

Homer F. Staley, *Chairman*,

Committee on Research, Enamel Division, American Ceramic Society.

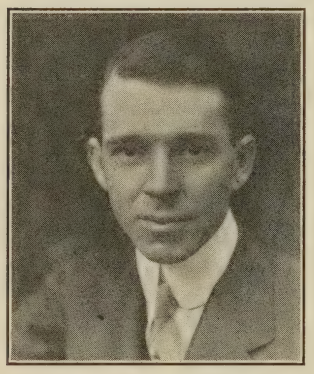
REPRESENTATIVE ON DIVISION OF CHEMISTRY AND CHEMICAL TECHNOLOGY NATIONAL RESEARCH COUNCIL

Dr. Wm. M. Clark, Chairman of the Research Committee of the Society has been appointed representative of the Society for a term of two years on the Chemical Division of the National Research Council.

ARTHUR FREDERICK GREAVES-WALKER

Director, Department of Ceramic Engineering North Carolina State College, Raleigh, N. C.

A department of ceramic engineering at North Carolina State College was authorized last year by the legislature and funds provided for equipment of an instructional staff. There is the assured financial support necessary to permit the department developing to the maximum facilities and service.



Mr. Greaves-Walker, after several months of negotiations, has been prevailed upon to direct this new educational department. He will also retain his interests with Stevens, Incorporated.

Mr. Greaves-Walker has an international reputation as a ceramist through his publications. He has proven his ability to manage and to solve production problems. His personality and progressiveness insures for him a place in the front rank as an educator and investigator. North Carolina State College is fortunate in having secured Mr. Greaves-Walker to direct the affairs of this new department. For a personal sketch of Mr. Greaves-Walker see *Jour. Amer. Ceram. Soc.*, **6** [1], 44(1923).

H. G. SCHURECHT LEAVES MELLON INSTITUTE

H. G. Schurecht, Senior Incumbent of the Multiple Industrial Fellowship sustained in Mellon Institute of Industrial Research by the Clay Products Association and the Eastern Clay Products Association, has resigned to accept the directorship of the research laboratory of the National Terra Cotta Society. While Mr. Schurecht assumed his new duties on September 1, it is understood that the selection of his successor has not been made by Mellon Institute.

NECROLOGY

Max F. Abbé

Announcement has been received of the death of Max F. Abbé, Chairman of the Board of Directors of the Abbé Engineering Company, on July 3, 1924. The Abbé Engineering Company has a corporation membership in this Society.

T. Wilfred Owen

T. Wilfred Owen, also a member of the Society met death recently by drowning. Mr. Owen was Ceramic Engineer for the Queen's Run Refractories Co., Inc., at their Lock Haven, Pa., plant.

BIBLIOGRAPHIES ON REFRACTORIES

The Refractories Division of the SOCIETY has ready for distribution a Bibliography of Magnesite Refractories. It has a Bibliography of Silica Refractories in the press. Several hundred references and abstracts are in manuscript form for a Bibliography on Clay Refractories. Bibliographies of other types of refractories will be compiled.

The Bibliography on Magnesite Refractories may be had by sending 10 cents postage to office of the SOCIETY'S General Secretary, Lord Hall, O. S. U., Columbus, Ohio.

THE GEOLOGICAL SURVEY COMMITTEE

The Geological Survey committee is preparing for early distribution (1) a directory of dealers of ceramic materials and (2) a bibliography on clays. The Committee will welcome suggestions and information. Address Dr. S. L. Galpin, Iowa State University, Ames, Iowa.

FELDSPAR INVESTIGATION

The Bureau of Standards with some of the universities and industrial laboratories collaborating will investigate the properties and constancy of the feldspars. This is being done at the suggestion of and in coöperation with the AMERICAN CERAMIC SOCIETY.

There is "malice toward none and charity toward all" in this investigation. With eye simply on the best welfare of all, the White Wares Division of the SOCIETY has made honest effort to get to the facts regarding the availability and quality of domestic feldspar. The facts "must out." In no other wise will the ceramic manufacturers be able to produce the best ware possible and in no other wise will the feldspar producer know the use to which his products is best fitted. An illuminating lamp to the feet of both producer and consumer is the only purpose of these investigations.

The scheme and scope of investigation which is now being undertaken is set forth in the communication from Dr. George K. Burgess, Director of the Bureau of Standards. This is but one portion of the investigations to be undertaken. It is the most logical "next step." A cursory review of the milling practices has already been made and reported. This will be followed by a survey of the feldspar resources with chemical, physical, microscopic and service studies of field samples illustrative of the extent and uniformity of deposits.

Full and frank coöperation in these investigations will be given by all who are willing to do business on the basis of "the truth, the whole truth and nothing but the truth."

Enclosed you will find a brief outline of an investigation on feldspar which it is proposed to conduct at this Bureau. The investigation is to be coöperative with the AMERICAN CERAMIC SOCIETY and, as the outline indicates, is divided into two major parts.

The first is to be coöperative with other institutions and comprises tests suggested by the Whiteware Division of the CERAMIC SOCIETY. It is believed to be very desirable to determine the factor of experimental error in the determination of softening points, and chemical and screen analyses, by comparing data on the same samples from at least five separate sources. In addition, the Bureau will determine the actual fusion points (expressed in °C) and conduct an "air analysis" on all feldspars submitted.

The second part comprises tests which will be conducted solely at the Bureau and will be comparable with previous Bureau investigations of ball clay, whiting, and flint.

It has been suggested by Mr. R. V. Miller (Knowles, Taylor & Knowles Co.), as the representative of the American Ceramic Society, that we obtain from you a sample of each of the following feldspars: (Feldspars listed.)

The Bureau and the Society will greatly appreciate your coöperation in this matter. It is requested that you forward not less than a 100-pound sample of each of these feldspars, prepaid, to the Bureau of Standards, Washington, D. C., attention IX–I–F.

Respectfully,
(Signed) George K. Burgess, *Director*.

Feldspar Investigation, Bureau of Standards

Part I. Suggested by White Ware Division.
- A. Softening point in cones (coöperative).
- B. Fusion point (°C).
- C. Chemical analysis (coöperative).
  1. K_2O–Na_2O–$CaO.MgO$.
  2. $SiO_2.Al_2O_3$ ratio.
- D. Screen analysis (coöperative).

Part II. Suggested by Bureau.
- A. Viscosity during softening range.
- B. Effect on body.
  1. Burning range in cones and °C.
  2. Porosity.
  3. Color.
  4. Strength.
     - *a* Impact.
     - *b* Chipping.
     - *c* Quenching.
- C. Petrographic examination.

Suggested Coöperating Institutions

Rutgers College	New Brunswick, N. J.
New York State School of Clay-Working and Ceramics	Alfred, N. Y.
Ohio State University	Columbus, Ohio.
University of Illinois	Urbana, Ill.
General Electric Co.	Schenectady, N. Y.
Onondaga Pottery Co.	Syracuse, N. Y.
Western Electric Co.	Chicago, Ill.

INVITATION EXTENDED BY A.A.A.S.

Since the American Ceramic Society has become affiliated with the American Association for the Advancement of Science, all the members of the Society who are not already enrolled in the A.A.A.S. have the privilege of joining the Association without paying the usual five-dollar entrance fee. This privilege will remain open for one full year from October 1 next. We are sure that many of the members of the Society will be glad to take advantage of the privilege and will become good supporters of the broad aims of the Association. Of course the A.A.A.S. needs the support of all who are interested in the general advancement of science and education and in the coöperation of the numerous sciences toward the improvement of science, education, and knowledge in general.

We wish to call the attention of the members of the American Ceramic Society to the nature and work of the A.A.A.S. and to the existence of the special privilege mentioned above. After the year above defined is completed the privilege will be restricted to *new* members of the Society, who will have the privilege till one year after the next October first following their election to the Society.

NOTES AND NEWS

BUREAU OF MINES NOTES

Silica Investigations

In the course of a general study of the technology of silica, being conducted by the Department of the Interior through the Bureau of Mines, observations have been made recently in the glass-sand and ganister districts of Mapleton and Mt. Union, Pa., and Berkeley Springs, W. Va. Methods of quarrying and mining were studied, including the use of explosives. Although the workings are all open cuts in the glass-sand quarries, loading of ore is done almost entirely by hand. In only a few instances are steam shovels used.

Washing or milling plants for glass-sand are very much standardized in the two districts, with the exception of methods of handling the wet, washed sand. These varied from hand feeding of bucket elevators to overhead traveling cranes with clam-shell bucket. The output of the two districts is almost the same, as far as quality is concerned, as they are mining the same bed of sandstone and using similar methods. One pulverizing plant at Berkeley Springs was visited where the washed sand is ground in tube mills. The product is used almost entirely in the ceramic industry. In all, nine plants were visited in the two districts.

Additional samples of silica were collected and a study begun of the difference in finished product between material ground in batch type and continuous mills. In connection with this, determination of grain size of finished products was made on several samples. Screen analysis and microscopic examination were made on samples of glass sand collected.

The Milling of Garnet

Gravity separation of abrasive garnet from hornblende, minerals which are intimately associated in the New York deposits, presents difficulties owing to the small difference in the specific gravity. It is believed that a detailed study of milling methods would not only be of assistance to garnet producers, but the data obtained from such a study would be useful in its application to problems in the milling of other ores and minerals. Such a study will be undertaken by the Department of the Interior, the work being assigned to the New Brunswick, N. J. and Rolla, Mo. experiment stations of the Bureau of Mines.

Refractory Service Survey at Boiler Plants

R. A. Sherman, Department of the Interior engineer, is making observations in the vicinity of New York City, in the course of a survey of refractory service in boiler-furnace plants being made by the Bureau of Mines. Observations were recently made at Providence and Pawtucket, R. I., and near Boston, Mass. This survey gives promise of definite results in promoting the interest of power-plant engineers in refractory problems and in the obtaining of coöperation of research organizations in solving these problems.

Removal of Sulphur from Ceramic Wares

Under a general investigation into the oxidation of ceramic wares during firing, being conducted by the Interior Department at the Columbus, Ohio, experiment station of the Bureau of Mines, a study has been undertaken on a semi-commercial scale to test methods that have been developed in a laboratory way for the more rapid removal of sulphur from ceramic wares during firing.

Several shales and fire clays have been chemically and microscopically tested for suitability in the work and a procedure has been worked out for a series of semi-commercial burns. A ton of a North Columbus shale which is particularly difficult to oxidize has been obtained and a number of standard bricks made up. They will be fired in lots of fifty each. Preparations are complete for making the required measurements during the firing and of so controlling and varying the temperature and atmosphere as to get the results desired.

It is planned to fire the kiln in forty-eight hours on a compressed schedule adopted from a commercial kiln recently tested. The first few burns will be for the purpose of developing a technique.

Alum from Clay

What is believed to be a much-needed simple, cheap method for the manufacture of pure alum and aluminum salts from impure clays has been devised by Department of the Interior investigators attached to the Pacific Experiment Station of the Bureau of Mines at Berkeley, California. The process, when perfected, should replace present methods in which pure salts cost about twice as much as impure salts.

Large scale tests on the preparation of aluminum sulfate have been completed by the Bureau of Mines. In these tests, using a unit charge of one ton, the results confirm the conclusions drawn from 100-pound runs previously made, in that it is practicable by a preliminary treatment with acid to remove the iron to a mere trace and most of the potash. This leaves an iron-free residue which can be worked up into aluminum sulfate. Alunite consists of aluminum and potassium sulfates, with iron and other minerals present as impurities. Removal of the iron has been the most difficult problem. Experiments are being continued with the object of determining the best conditions of temperature, pressure, and other factors for maximum efficiency of the process.

Mineral Fillers

A study of the size and character of grains of non-metallic mineral fillers has been completed by the Department of the Interior at the Southern Experiment Station of the Bureau of Mines, Birmingham-Tuscaloosa, Alabama. Mineral fillers are those non-metallic minerals that, after being pulverized, are used in the preparation of various manufactured articles. Kaolin, whiting, chalk, ground limestone and marble, silica, ocher, mica, talc, barite, slate flour, graphite, and diatomaceous earth are the chief mineral fillers. Different forms of some of these minerals are employed; as, for example, silica may be ground quartz, or pumice, or tripoli, the fine rounded grains resulting from the weathering of chert.

Each mineral has properties that make it suitable for certain uses. These properties are color, specific gravity, the nature of the surface, and the shape and, probably of greatest importance, the size of the particles. Most fillers are used essentially as inert substances to occupy space, fill voids, or impart color, but in some lines of manufacture they have an important but not easily understood effect on the physical properties of the finished article. For example, ground barite and marble, aside from their specific gravity, have particles that are much alike in appearance and shape, and yet the

properties they impart to a rubber compound are quite different. Of chief importance in the comparison of fillers from the same mineral, and to a less degree of fillers from different minerals, are the average particle size, the variation in size from maximum to minimum, and the proportionate amounts of the different sizes; the shape of the grain ranks second and applies more especially to the comparison of fillers from different minerals.

Although fillers are used in a great number of industries, the bulk of the material goes into the following products: Paper, wall-paper, prepared roofings, rubber, paint, linoleum, oilcloth, foundry facing, plastic cements, oxychloride cement, artificial stone, polishes and scouring compounds, matches, dressing and dusting powders, various textile products, such as window shade cloth, and phonograph records.

Details of methods of determining the average particle size and proportions of grains of different sizes are given in Technical Paper 296, by W. M. Weigel, mineral technologist, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

BUREAU OF STANDARDS NOTES[1]

Novel Experiment in the Casting of Heavy Clay Ware

The Bureau of Standards recently completed the drying of three experimental pots (outside dimensions $3^1/_2$ feet high by 4 feet 9 inches in diameter, and a maximum wall thickness of 5 inches), designed to be used in the melting of glass. For casting each pot one and one-half tons of slip were required.

The first step in the production of these large pots was the making of the plaster mold in which they were to be cast. Ten tons of plaster of Paris were used in this undertaking, and several problems of interest developed in the course of the work. It was found that a coddle (temporary form) made of battleship linoleum and reinforced with wood slats, which had been used in previous work of this kind, was not sufficiently strong to withstand the hydraulic head of five feet of plaster slip. Special precautions were also required to adequately seal the bottom of the coddle. In addition to this the equipment available necessitated mixing and pouring as many as eight batches of three-hundred pounds of plaster (plus water) each, in the casting of a single section of the mold. Since the various sections had to be turned to the proper shape, the batches of plaster slip had to be retarded progressively so that the entire section would set uniformly. If this had not been done, the bottom part of a section would have set up too hard to be worked with the hand tools employed, while the top layer would still be too soft.

A coddle of sufficient strength was made by using Number 20 gage sheet iron secured by means of small bolts. The bottom of this coddle was sealed by setting it in a groove in the plaster base and filling this groove with plaster, which was allowed to harden before the casting was started. The groove was about one inch wide by one inch deep. After several experiments with an organic retarder it was found that the addition, to every batch of 300 pounds of plaster, of one ounce for every batch remaining to be poured produced the desired time of set. That is, if it was estimated that six batches would be required to cast a certain section, six ounces of retarder would be added

[1] Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

to the first, five to the next, and so on. The mold was cast and turned to shape on a surfacing wheel which is ordinarily used in grinding the faces of special refractory shapes and which, in this case, functioned as a turning wheel or lathe.

The mold was constructed according to designs developed at the Bureau and photographic records were kept of the various stages of the work.

As previously stated, one and one-half tons of slip were required to cast one pot, and no particular difficulty was experienced in this phase of the work, although it was necessary to blunge the slip in four separate batches, keeping the first agitated in an especially adapted mixer until the last was ready for casting. The body composition and deflocculating agent were the same as used in the casting of much smaller shapes, the only departure from the usual procedure being in the greater amount of time required in preparing the slip and the time required for the slip to set up in the mold.

Use of Texas Kaolin in Whiteware Bodies

The Bureau of Standards recently conducted a short investigation in a sample of kaolin taken from a large deposit in Texas. The material was practically pure white in color, very uniform and, as received, was comparatively coarse grained and without plasticity.

Six whiteware bodies, varying in ball clay content from 0 to 14 per cent, and in which the English china clay was replaced in increasing amounts by Texas kaolin, were prepared and made up in the form of test bars, circular discs, and 5-inch plates. These were fired to cones 8 and 10. The test bars were used in determining shrinkage, transverse strength, and absorption, and the discs were used in determining relative resistance to impact. In addition, several shapes were made by the casting process, using slips containing Texas kaolin. The bodies obtained were very high in transverse strength when dried. The fired bodies were of an exceptionally white color, but had a high absorption, and were correspondingly low in transverse strength and resistance to impact. The glaze specimens were very good as regards resistance to crazing. The results as a whole indicated that Texas kaolin could be used satisfactorily in whiteware bodies, but because of the relative coarseness of grains and its high refractoriness, it would require more preliminary grinding than the English clays as well as the use of a larger percentage of ball clay to produce the desired dried and burned structure in the body.

Refractory brick were also made, using the Texas kaolin, both the grog and the bond being composed entirely of this material. The brick required burning at temperatures equal to those used in the production of diaspore and silica brick, but when made in this way the product appeared to be of very good quality.

Circular on Inspection of Portland Cement

With the growing demand for the inspection of structural materials there has been an increase in the number of inquiries received at the Bureau as to proper methods for carrying out the inspection of Portland cement. Much has been written about the inspection of Portland cement, but it appears that there is a real need for a paper dealing more fully with the work from an inspection viewpoint. Based upon the experience of the Bureau in caring for Government purchases of cement, Messrs. John R. Dwyer and Roy N. Young of the cement section have prepared a paper entitled "Inspection of Portland Cement." Often an inspector who is familiar with the various mill processes involved and the routine of inspection is called upon to make a decision which has no precedent in his experience. It is not intended that this paper shall be so far reaching as to be of assistance in all such cases, but during long experience in this work at widely scattered points certain procedures of inspection as outlined have been demonstrated

as being the most effective in avoiding complications and in holding the confidence and respect of all parties to the transaction.

This paper was published as two articles appearing in the August and September 1923 issues of the *Concrete Magazine*. However, to give it wider circulation and to care for the inquiries more promptly the Bureau has prepared it as a mimeograph circular and copies may be obtained upon request. It is hoped that the information it contains will be of assistance in conducting true inspection of cement.

Service Life Tests of Screen Wire Cloth

The Bureau has been requested by the American Society for Testing Materials to take charge of exposure tests on screen wire cloth. The program will include exposure tests of standard No. 16 mesh screen, made of copper, commercial bronze, low brass, aluminum bronze, silicon bronze, and Ambrac metal. It is planned to expose the specimens at four locations; an inland location, an industrial center, on the seacoast in a temperate climate, and on a tropical seacoast. The cloth of each material will be exposed in painted frames capable of withstanding the elements. These frames will be of three types, 12 × 12 inch wood, 30 × 36 inch wood, and 30 × 36 inch metal.

The problem of suitable places for the exposure tests has been taken up with the various coöperating manufacturers, the Bureau of Mines, Bureau of Lighthouses, and the Panama Canal.

Special Refractories for Platinum

Some very satisfactory tests have been made using cast crucibles made from fused zirconia for melting platinum, chromium, and silica. One of the most interesting tests was the fusion of silica sand in a zirconia crucible in the induction furnace. No slagging or erosion of the zirconia by the fused silica could be seen on breaking apart the solidified melt. A cast crucible with walls 2 mm. thick had sufficient strength at 1750°C to hold a 150-gram melt of pure chromium. The walls of the thin crucible were without any outside support during the test.

ANNOUNCEMENT OF THE CUSHMAN GRADUATE FELLOWSHIP IN CHEMISTRY

Western Reserve University

Mr. H. D. Cushman, President of the Ferro Enameling Co. of Cleveland, has established a Graduate Fellowship in Chemistry at Western Reserve University, for the investigation of the gases dissolved in fused silicates.

The holder of the Cushman Graduate Fellowship will receive a stipend of $750.00 and exemption from tuition and laboratory fees which would amount approximately to $250.00. In addition to his research the Fellow will be permitted to pursue advanced courses toward a graduate degree. The requirements for the degree of Master of Arts could be met in one year.

This fellowship is open only to graduates of accredited colleges. Applicants should have a thorough foundation in chemistry and physics, should be experienced in the manipulation of gases, and skilled in the simpler operations of glassblowing. Letters of application must be accompanied by a recent photograph of the applicant, by a transcript of the applicant's undergraduate and graduate record, and by sealed lettres from qualified persons, indicating his character and ability.

Applications to be considered must be received not later than Septembert 6, 1942 Send applications to: The Cushman Graduate Fellowship, Morley Chemical Laboratory, Western Reserve University, Cleveland, Ohio.

ANNOUNCEMENTS OF THE COMMON BRICK MANUFACTURERS ASSOCIATION[1]

A Magazine for Brick

The brick manufacturers are at last given the opportunity to have a national magazine devoted exclusively to the interest of their product. The Directors of the Common Brick Manufacturers' Association, at their mid-summer meeting, approved the plan for the publication by the Association of a monthly magazine. The question of financial support was thoroughly discussed. While funds could be derived from advertising, it was considered that by accepting advertising they would in some measure antagonize existing publications conducted for profit, which now are friendly to us and are liberal to us in the matter of space. The other means of support is to sell subscriptions to the magazine to the brick manufacturers, and this method was decided upon. Every manufacturer may profitably send this publication to a number of architects, engineers, contractors, supply dealers and prospective builders in his own locality, and if the members indicate the coöperation, which we believe they will, the magazine will be an assured fact and will have its first issue out in September. During the coming week a prospectus showing the size and cover design of the magazine will be sent to every member of the organization, and with this a coupon for them to indicate how many subscriptions they will take. The subscription price is $1.00 a year. Every manufacturer should make up a list, from 100 to 500 names, of persons who can be developed as prospective brick buyers, and sent it to the Association. The member will be billed monthly for these subscriptions, and the work of mailing will be done at this office. There will be no expense to the member except to purchase as many subscriptions as he can use at $1.00 a year. We urge prompt response to the circular which will go out during the week.

Machinery Exhibit

In connection with the annual convention of the Common Brick Manufacturers' Association in Chicago the week of February 9, 1925, an innovation will be introduced. Large space has been rented immediately adjoining the convention hall at the Drake Hotel for a comprehensive exposition of clay working machinery and equipment. Response from the machinery manufacturers thus far has been almost unanimously favorable to this enterprise, and the brick manufacturers attending the meeting at Chicago will have an opportunity to meet a great number with whom they do business and witness a display of everything that is new and interesting in machinery and equipment. The exposition is to be made a feature of convention week and the convention sessions so arranged that there will be ample time for thorough study of the exhibits.

GREAT PROGRESS IN STANDARDIZATION SHOWN BY A.E.S.C. REPORT

There now exists the most wide-spread interest and activity in industrial standardization that has ever been shown, according to the new Year Book of the American Engineering Standards Committee.

The work of the Committee is indicative of the growth of the movement as a whole. One hundred and fifty-two projects have been completed, or are under way, and in these various projects two hundred and thirty-five national organizations, technical, industrial, governmental, are officially coöperating through accredited representatives. The

[1] Issued Aug. 9, 1924 by the Common Brick Mfrs. Assn., Cleveland, Ohio.

number of the individuals serving under various sectional committees of the different projects is nearly 1100.

Of the projects which have reached an official status, 31 have to do with civil engineering and the building trades; 25 with mechanical engineering; 15 with electrical engineering; 4 with automotive subjects; 11 with transport; one with ships and their machinery; 14 with ferrous metals; 15 with non-ferrous metals; 12 with chemical subjects; 2 with textiles; 5 with mining; 5 with the wood industry; 1 with the paper and pulp industry; and 11 projects with topics of a miscellaneous or general character.

Coöperation in joint activities between Mr. Hoover's Division of Simplified Practice and the American Engineering Standards Committee has steadily increased. In general the work of the Committee is concentrated upon standardization projects which involve technical considerations, while the Division of Simplified Practice concentrates upon such eliminations as it is possible to carry out from a consideration of statistical production data alone, or as stated in the book on trade association activities issued by the Department of Commerce, "the layman can proceed successfully with a simplification program, while it would be impossible for him to consider seriously standardization problems by himself."

In order to meet the demands made upon it by industry, and to supply the needs of the various working technical standardization committees, the American Engineering Standards Committee has greatly broadened its information services, and has added an Engineer Translator to its staff for this purpose. In this way, complete information is made available to sustaining members, trade and technical associations and other inquirers on standardization activities in foreign countries, as well as in the United States.

The information service is becoming of increasing importance in connection with foreign trade. Exporters are frequently asked to bid on goods to comply with foreign specifications, or in accordance with an unfamiliar trade name or designation, information regarding which they do not have available. Through its information service, the A.E.S.C. has on many occasions supplied copies of standards, or details of information based on a study of foreign standards, in accordance with which bids could be prepared intelligently, thus enabling the American firm to submit its bid by cable, when without such service it would have been unable to act in time.

A new development is the appointment of local representatives of the Committee in four important industrial centers. These are: K. F. Treschow, Secretary, Engineers Society of Western Pennsylvania, Pittsburgh; J. B. Babcock, Executive Secretary, Affiliated Societies of Boston, Boston; Edgar S. Nethercut, Secretary, Western Society of Engineers, Chicago; Professor George S. Wilson, Engineering Experiment Station, University of Washington, Seattle.

One of the most striking developments of the standardization movement is the increasingly important role which trade associations are playing in it. More than 140 national trade associations are officially participating in standardization projects under the auspices of the American Engineering Standards Committee. That standardization is a legitimate and constructive activity for associations is everywhere recognized, and explicitly so by a recent decree of the U. S. District Court at Columbus, Ohio.

Standardization, being essentially a coöperative undertaking, must necessarily be predicated upon some form of organization. To carry out a piece of standardization work throughout an industry, it is practically essential that there be some form of organization covering this particular industry, even though it be a loose-knit one. More and more trade associations, no matter for what purpose they may have originally been organized are going into technical work, and it is natural if not inevitable, that both trade and technical associations should eventually concern themselves to an in-

creasing extent with standardization activities. This tendency is becoming more marked on every hand.

The Year Book may be secured by addressing the American Engineering Standards Committee, 29 West 39th Street, New York City.

TEN MILLION DOLLAR CAMPAIGN[1]

The National Museum of Engineering and Industry announces its campaign for $10,000,000.

One million dollars has been assured towards the establishment of the National Museum of Engineering and Industry, Incorporated, with headquarters in the Engineering Societies Building. A campaign to raise an additional nine million dollars starts today. The president of the new organization is Dr. Elihu Thomson who today receives the Kelvin Gold Medal from the Royal Society at the Kelvin Centenary in London. The Vice Presidents are Dr. Edward G. Acheson, one of the creators of the modern abrasive industry, Dr. Leo H. Baekeland, inventor of Velox paper and Bakelite, he is President of the American Chemical Society, and Dr. Edward Weston, creator of the Weston type of electrical instruments. Its Trustees are Mr. Philip T. Dodge, Chairman of the International Paper Company, Mr. Howard Elliott, Chairman of the Northern Pacific Railroad, Dr. Ira N. Hollisk, President of the Worcester Polytechnic Institute, Dr. Elmer A. Sperry, President of the Sperry Gyroscope Company, and Mr. Worcester R. Warner, of Warner & Swasey, Cleveland, Ohio, makers of the great telescopes of the world. Mr. George E. Roberts, Vice President of the National City Bank, is Treasurer, and Mr. H. F. J. Porter, Industrial Engineer, is Secretary.

In coöperation with the Smithsonian Institution the new organization is planning to erect on its grounds in Washington a building to house the original models of early inventions and the records of constructive achievement of pioneers, inventors, and engineers in the development of transportation and industry. In this way the United States will be given the kind of institution which all the great European nations have possessed for years, and in the layout of the proposed museum use will be made of the data collected by an expert who has recently returned from a year's survey of museum practice abroad.

An important departure in the American scheme is proposed however, made necessary by the vastness of the country. In addition to the central collection at Washington special collections such as replicas of the historical exhibits will be carried to the people, also live machinery of modern processes will be placed in affiliated museums in industrial centers of every state.

Already old models and records long forgotten have been located and resurrected and this winter will be exhibited at the headquarters as a demonstration of how the ultimate collection will appear.

Incorporation was effected in March last under the laws of the District of Columbia by the "Organizing Committee of 100" composed of chairmen of boards of directors, presidents and chief engineers of industries and railroads, and professors of engineering and history in universities and colleges.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING

Over 260 exhibitors have been assigned space at the Third National Exposition of Power & Mechanical Engineering which will be held in the Grand Central Palace, New

[1] Natl. Museum of Eng. and Industry, 29 W. 39th St., N. Y. City, July 10, 1924.

York City, from December 1 through December 6. As this number is more than two times greater than those who had engaged space on August first a year ago, the indications are that the coming event will be of tremendous interest and importance.

The 1923 Exposition drew an attendance of 62,079 engineers, executives, financiers, operating men, as well as large numbers of engineering students with their instructors. This is an increase of 15,000 over the number who attended the 1922 Exposition.

As the expressions of appreciation and interest in the 1923 exhibit were proof of the value of the Exposition and as the large attendance of vitally interested visitors was a great satisfaction to those exhibiting, it is safe to assume that the coming event will greatly surpass all of its predecessors. The constant growth of the Exposition is interesting proof that the industries related to power and mechanical engineering are in a state of rapid development, and need the inspiration and ideas started at the Exposition. The growth of the Exposition has also been an object lesson to these industries, for in addition to giving the engineering and general public an idea of the size and importance of the industries, it has dignified the industries in the eyes of those engaged in them and presented a perspective of functions and methods that nothing else could have provided.

The Exposition will, as usual, parallel the meetings of The American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. The A.S.M.E. meeting will be held in the Engineering Societies Building, 29 West 39th St., New York City, and the A.S.R.E. meeting will be held at the Hotel Astor, New York City. Plans are under way for the American Society of Heating and Ventilating Engineers to have a gathering of Local Sections during the time of the Exposition. The coöperation of the various engineering societies has been valuable, since it enables members to attend the meetings and at the same time see the interesting exhibits at the Grand Central Palace.

The management of the Exposition is assisted by an Advisory Committee of designing and operating engineers. For the coming Exposition this Advisory Committee has been augmented by George A. Horne of New York, President of A.S.R.E.; Homer Addams of New York, President of the A.S.H.V.E., and John H. Lawrence of New York. Mr. Lawrence served on the Committee the preceding year during his term as Chairman of the Power Division of the A.S.M.E.

The American Society of Mechanical Engineers, the National Electric Light Association and the National Association of Stationary Engineers are already represented on the Advisory Committee by their officers. The A.S.M.E. delegation consists of the President, Fred R. Low; Chairman of the Professional Divisions Committee, James Partington; Chairman of the Power Division, Nevin E. Funk; and the Secretary Calvin W. Rice. The N.E.L.A. is represented by the President, Walter H. Johnson, and the N.A.S.E. by Past-President, Fred Felderman. The balance of the Advisory Committee who hold over from year to year are I. E. Moultrop, Chairman, of Boston; W. L. Abbott, Chicago; N. A. Carle, Newark, N. J.; C. F. Hirshfeld, Detroit; O. P. Hood, Washington, D. C.; E. B. Katte, New York; David Moffat Myers, New York; and Fred W. Payne and Charles F. Roth, managers of the Exposition, with offices in the Grand Central Palace.

MANAGEMENT WEEK—OCT. 20-25

Management hits all branches of endeavor. Sixty-five cities are holding meetings on the same subject is somewhat unique even in this land of the unusual. Five national societies are sponsoring these activities—*i. e.*,

American Management Association
American Society of Mechanical Engineers
National Association of Cost Accountants
Society of Industrial Engineers
Taylor Society.

Should you desire specific information at any time regarding Management Week, it will be promptly given by Ernest Hartford, 25–33 West 39th St., New York, N. Y.

An official representative of each Society has been appointed to serve on a national committee on arrangements. The personnel of this Committee is as follows: Henry Bruere, the representative of the American Management Association; Sterling H. Bunnell, representing the American Society of Mechanical Engineers; W. H. Leffingwell, representing the Taylor Society; E. M. Robinson, representing the Society of Industrial Engineers, and C. R. Stevenson, representing the National Association of Cost Accountants. At the organization meeting, C. R. Stevenson was elected permanent chairman of the Committee and Ernest Hartford secretary. It is the wish of the Committee that all correspondence be directed to its secretary at the Engineering Societies' Building, 25–33 West 39th Street, New York.

To Secure Aid of Local Clubs

At present the Committee is engaged in compiling a list of the cities where there are local organizations of any of the five national societies. It is proposed to hold meetings at each of these places and to appoint as local committees the chairman or president of the local branches of the national society. Where there is no local branch, the national society will designate one of its members residing in the community to serve on the committee. These local committees, in addition to having charge of all arrangements for their local meetings, will also be encouraged to secure the interest of local civic organizations, such as the Rotary Club, Kiwanis Club, Lions Club, Chamber of Commerce, etc. The plan is to have each of these civic organizations devote its meeting during the week of October 20 to a subject on some phase of management. The keynote of the meetings this year will be Budgeting for Better Management.

The National Committee is developing a publicity bureau from which will be disseminated fortnightly the latest announcements in the development of the general plan. The Committee will also issue bulletins bi-weekly to the various sub-committees throughout the country.

The Committee will be glad to receive suggestions and constructive criticism from anybody having ideas on the subject and will also welcome the receipt of contributions from authors or suggestions of desirable speakers who may be interested in presenting papers during Management Week.

AMERICAN INSTITUTE TO HOLD BIG EXPOSITION OF INVENTIONS

Manufacturers in every American industry will be interested in the Exposition of Inventions to be held, December 8 to 13 inclusive, 1924, in the famous Engineering Societies Building, New York City. The American Institute of the City of New York is handling this display through its Inventors' Section, with behind it an experience of ninety-six years in fostering and portraying American industrial life.

A feature of the Exposition will be exhibits from the leading American industries showing developments of various machines, utilities and processing methods. In all

fields the ingenuity of the inventor and the part he has played in the progress of America will be emphasized.

In this display of American inventions the American Institute will be continuing with a new emphasis almost a century's encouragement of inventors and introduction of their works to the public. Among inventions now used throughout the world that were first displayed to the public at earlier All-American fairs of the Institute are the Morse telegraph, the Hoe lightening printing press, the McComick reaper, the Howe sewing machine, the Bell telephone, the Colt revolver, the Francis metallic life boat, and many others.

The American Institute also established the first permanent exhibit—an idea later adopted in various industries—where "machines, models, specimens and drawings" were displayed to the public. Great annual fairs of the Institute, begun in 1828 and held at such widely known places in their times as Niblo's Garden, Castle Garden, Crystal Palace, Palace Garden, the Academy of Music and Madison Square Garden, in New York City, portrayed year after year the advancements in agriculture, commerce, manufactures, science and the arts until, with the expansion of the country's business in the last quarter century, the idea developed into the more famous world fairs and national and international industrial expositions under various auspices and managements.

Arrangements for the display of working models or actual devices at the Exposition of Inventions can be arranged through a Committee of the American Institute at 47 West 34th Street, New York City. All proposed displays are subject to approval by the Institute, it being the desire to show only those things of sound worth.

ANNOUNCEMENT OF CHEMICAL EXPOSITION DATE

There will be no Exposition of Chemical Industries in 1924. The next Exposition of Chemical Industries will be held September 28 to October 3, 1925, at the Grand Central Palace, New York.

"This Exposition will not be held in the United States prior to September, 1925," states the announcement of the management. As a result of a vote of exhibitors, taken last year, the decision was definitely reached at that time not to hold the exposition in 1924, but to skip a year and hold the next one in 1925.

At the meeting in 1923, where time and place for the next Chemical Exposition were discussed and decided upon, the exhibitors decided by a large majority to hold all future expositions in New York, and selected the Grand Central Palace for 1925.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	Oct. 6–7, 1924	Los Angeles, Calif., Hotel Biltmore
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Assn. Adv. of Science	Dec. 29, 1924—Jan. 3, 1925	Washington, D. C.
Am. Assn. of Museums	1925	St. Louis, Mo.
Am. Assn. Flint and Lime Glass Mfrs. (Quarterly Meeting)	Oct., 1924	Pittsburgh, Pa.

Am. Assn. Flint and Lime Glass Mfrs. (Annual Meeting)		Atlantic City, N. J.
Am. Chemical Meeting	Sept. 8–13, 1924	Ithaca, N. Y.
Am. Concrete Inst.	Feb. 24–27, 1925	Chicago, Ill.
Am. Electrochemical Society	Oct. 2–4, 1924	Detroit, Mich.
Am. Engineering Council (Administrative Board)	Oct. 17–18, 1924	Chicago, Ill.
Am. Face Brick Assn.	Dec. 2–4, 1924	Hot Springs, Va.
Am. Foundrymen's Assn.	Oct. 11–16, 1924	Milwaukee, Wis.
Am. Gas Assn.	Oct. 13–17, 1924	Atlantic City, N. J.
Am. Inst. of Architects	1926	Atlanta, Ga.
Am. Inst. Min. & Met. Engineers	Oct. 13–15, 1924	Birmingham, Ala.
Am. Mining Congress	Sept. 29–Oct. 4, 1924	Sacramento, Calif.
Am. Soc. of Mechanical Engineers	Dec. 1–4, 1924	New York City
Am. Soc. for Steel Treating	Sept. 22–26, 1924	Boston, Mass.
Am. Zinc Institute, Inc.	1925	St. Louis, Mo.
Assn. Iron and Steel Electrical Engrs.	Sept. 15–19, 1924	Pittsburgh, Pa.
Common Brick Mfrs. Assn. of Am.	Feb. 9–13, 1925	Chicago, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Exposition of Inventions	Dec. 8–13, 1924	New York City
Franklin Inst. Centennial	Sept. 17–19, 1924	Philadelphia, Pa.
Grinding Wheel Mfrs. Assn. of U. S. and Canada	Sept. 12	Pike, N. H.
The Gypsum Industries	Sept. 23–24, 1924	Chicago, Ill.
Hollow Bldg. Tile Assn.	Jan., 1925	Chicago, Ill.
Management Week (Auspices of Am. Soc. of Mech. Engrs.)	Oct. 20–25, 1924	New York City
Natl. Academy of Sciences (Joint Meeting) Harvard Univ. and Am. Acad. of Arts and Sci.	Nov. 11–12, 1924	Boston, Mass.
Natl. Assn. Brass Mfrs.	Sept. 17–18, 1924	Cleveland, Ohio
Natl. Assn. of Mfrs.	May, 1925	N. Y. City
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	March, 1925	Pittsburgh, Pa.
Natl. Assn. of Stove Mfrs.	May 13–14, 1925	New York City
Natl. Clay Products Industries Assn.	April, 1925	Chicago, Ill.
Natl. Glass Distributors Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Paving Brick Assn.	Dec., 1924 or Jan., 1925	
Natl. Safety Council	Sept. 29–Oct. 3, 1924	Louisville, Ky.
N. J. Clayworkers Assn. and E. Sect. of the Amer. Ceram. Soc.	Dec., 1924	New Brunswick, N. J.
Refractories Mfrs. Assn.	Oct. 3, 1924	Pittsburgh, Pa.
Tile & Mantel Contractors' Assn. of America	Feb. 9, 1925	Louisville, Ky.
U. S. Potters Assn.	Dec., 1924	Washington, D. C. (?)
Western Paving Brick Assn.	Jan., 1925	Kansas City, Mo.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Mary G. Sheerer, H. S. Kirk — Art
R. R. Danielson, H. G. Wolfram — Enamel
G. E. Barton, A. N. Finn — Glass
F. A. Harvey, R. F. Ferguson — Refractories
F. H. Riddle, C. C. Treischel — White Wares
W. D. Gates, B. S. Radcliffe — Terra Cotta
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Vol. 3 — October, 1924 — No. 10

EDITORIALS

WHAT BENEFIT DO YOU DERIVE FROM ANNUAL MEETINGS?

The annual meetings of this Society are for the purpose of collective consideration of technical and scientific problems, theories and facts. Much of this is accomplished in an orderly way through scheduled papers and discussions. It is the formal programs that make our meetings definite in results and effective in purpose. Programs are essential.

But by no means are all the benefits of these meetings derived from the formal programs. The closest confidences and best exchanges are in the "button-hole chats" and the private room "round-up." A meeting without these informal "get togethers" of a few kindred spirits would be lacking in much of the personal inspiration for which the annual meetings of this Society are noted.

The success of these annual meetings is dependent upon a hearty co-operation of many. It does not rest entirely upon the two hundred persons who contribute the papers. An interested audience is essential. Participation in the discussion with citations of observations and recitation of theories by several hundred persons is essential. All of these together are necessary to an informing and inspiring meeting, but the first essential is the program of papers.

The provision of an instructive program of papers should be a matter of concern to every member of the Society and to every firm represented.

The value of these meetings and of the *Journal* is dependent on the papers. It should be remembered that these are mutual enterprises in which each has an obligation as well as an opportunity.

It is very human for plant executives to withhold from publication the results of observations and investigations. Especially is this so if these investigations have been costly and if the results are directly responsible for a better product or lessening the cost of manufacturing. This editorial is not a criticism of this attitude and action of plant executives, but is prompted by the belief that the plant executives are thus withholding more from themselves than they are from their competitors.

In the first place, a coöperative enterprise like this SOCIETY cannot be effective without coöperation. Each must do his share. Each must contribute to the general fund of information.

And second, there is no person, or manufacturing organization which does not continually profit from the published findings of others. The more progressive and prospering manufacturers believe it to their advantage to stimulate the searching for and the publishing of facts relating to their peculiar problems by reporting some of their own findings. The non-industrial investigators are anxious for the problems known to be of industrial value. A reported research almost always causes a widespread research activity on that problem.

In the third place, successful manufacturing depends more on the knack of application than upon the knowledge of the principles and methods involved. Where manufacturers of like wares exchange information most freely concerning their methods and mixtures they continue with the same differences in manufacturing methods and have suffered no loss through increased competition. On the other hand, manufacturers of like products have benefited through free exchange of information and have maintained their usual margin of profit. They have raised the standard of their product and increased their markets. It is the experience of all groups who have thus coöperated intimately that each has profited, none has lost and the satisfaction derived from a better product at a lower cost has made coöperation worth while. Every manufacturing organization has more to gain than to lose through participation in the meeting programs and through publishing in the *Journal*. The gain comes from the exchanging with the others and from the stimulation which is thus afforded to the many university and bureau investigators. It would be an indication of an unproductive technical staff if there were no investigations which have only an indirect bearing on the product or on the special methods employed. Reports of results of such investigations are of value as general information. They constitute the instructive meeting programs and make the *Journal* valuable.

Withholding from participation in these programs is in fact withholding

much from self. Each person and each company would profit directly through participation in these annual meeting programs.

THE ECONOMIES IN JOINT CERAMIC RESEARCH

The unanimity of approval for an institute for ceramic research by the trade press expresses opinions of all those who have "thought this question through." That the ceramic manufacturers should be federated for the purpose of solving their common problems is no longer doubted. R. D. Landrum, president of the AMERICAN CERAMIC SOCIETY, has gone a step further in his suggestion that since it is deemed profitable for trade associations representing manufacturers of heavy clay products to organize into a separate institute, similar institutes of each group of ceramic products should be formed and all federated under a joint advisory and fundamental research directorate. There is enough in common in many of the problems and in the fundamental principles involved, to warrant such a federation. The success of this SOCIETY in federating these separate interests assumed by some to be diverse and too much unlike, is proof of the feasibility and of the economy of a ceramic research institute which in fact would be a federation of all ceramic manufacturers through their respective trade associations and institutes.

Our first recommended economy in ceramic research was that of a Ceramic Institute. The heavy clay products group of trade associations has already begun organizing their institute to be known, probably, as the Clay Products Institute. The whitewares manufacturers could with equal profit organize a ceramic Whitewares Institute and the glass manufacturers, a Glass Institute, each being a federation of trade associations.

President Landrum's economy recommendation is that these several group institutes should be federated into a general Ceramic Institute. The officers, libraries and personnel could thus be together on an orderly coöperative basis. This would reduce overhead costs and increase the productiveness of each.

Our third economy recommendation is one which is already favorably considered by the heavy clay products group; that of employing the research facilities already available in the federal state and endowed educational and research institutions, rather than setting up a laboratory owned and operated exclusively by ceramic manufacturers.

Other economies which will be had in scientific and technical research through a federation of the several groups, readily suggest themselves. Most of these are economies in the related problems and in the fundamentals common to all. Of large additional value return to the ceramic manufacturers would be the increased research activity in silicate chem-

istry and physics which would surely follow from the massed influence of a general federation of all the group institutes through a common head, the American Ceramic Institute.

There is power and economy in coöperation. A central research promotion and advisement with decentralized interest and support through each distinct group provides for the maximum force and economy to be had through coöperation and for the direct and personal problems of each group. This scheme of decentralized activities through a central coördinating head is the scheme of organization of the American Ceramic Society Each of the seven Divisions is self-constituted and managed but all are coördinated through the central organization. This provides for the maximum freedom to each Division to develop and to do for its constituents, and for the large economies and increased forcefulness to be had through coördination.

We continue our promotion of ultimately having an American Ceramic Institute in which each group will participate for its common good and the maximum economies. We believe this to be vital. Not until this federation of all the separate groups shall have been accomplished will ceramic science and technology be most economically and surely progressed. A centralized collaboration with decentralized special interests will be most impressive alike to fundamental investigators and the plant technologists. Thus each industrial group would have its special purposes served in the manner it shall decide and at the same time profit through the centralized or combined recording, searching and promoting agency.

This is real economy in the "reduced overhead expenses" and in the "increased overhead efficiency" obtained through coördination and collaboration. President Landrum's proposal is the best and most forward reaching proposition yet made. We continue our boosting for an American Ceramic Institute.

PAPERS AND DISCUSSIONS

DISCUSSION ON PLASTICITY[1]

By E. C. Bingham

Dr. Bingham: I have been greatly interested to have Mr. Cooke tell of the work which he has been doing. I had no thought of addressing you on the subject of plasticity myself although I shall be glad to attempt to answer any questions which may be raised.

The main thought that has grown from our work is of the illusory character of viscosity measurements when applied to suspensions and emulsions. The "viscosity" means practically nothing when the shearing conditions are not stipulated. Plasticity is a complex property made up of at least two variables and, therefore, it is highly improper to identify viscosity with plasticity or in any other way attempt to represent the plasticity as a simple property.

I have tried to find some way in which one can relate to each other *yield value* and *mobility*, but I believe that they are independent variables, which together make up plasticity. In suspensions of clays in water, for example, it may be possible by changing the concentration to obtain identical yield values, but they will not have identical mobilities and *vice versa*.

Plasticity is, therefore, a loose term which may continue to be used just as heretofore, and when it is to be given quantitative meaning this must be done in terms of yield value and mobility.

Mr. Cooke: I would suggest that Dr. Bingham tell us a little more about the properties of plastic substances that he has worked, on the concentration of zero yield value and the concentration of zero mobility and their interpretation.

Dr. Bingham: If the yield value and mobility are fundamental properties of solids which may be measured with precision, I think that the interpretation of these properties for a given industry will follow as a matter of course. How it will work out in the ceramic industry I do not know, although I may offer the following suggestion from our work on paints. We utilized paints for study largely because the dispersion medium, linseed oil, is non-volatile. Lithopone seemed suitable as a disperse phase. In Fig. 1 are shown the mobilities and yield values plotted against the weight concentration. Starting with the fluidity of linseed oil, the mobility is constantly lowered as the pigment is added to oil, until finally the mobility reaches a zero value.

If the mobility concentration curve is linear, it is only necessary to know the fluidity of the oil and the mobility of one concentration of paint in order to calculate the mobility of any mixture. We can also calculate

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Enamel Division)

the concentration of zero mobility, point D in the figure, where close packing takes place.

It is apparent that beyond the concentration of zero mobility any shear must be of a different character, since there is no longer sufficient dispersion means to fill the pore spaces.

The yield value also increases with the concentration and this increase over a considerable range appears to be a linear function of the concentration. The concentration of zero yield value A is where there is the transition from viscous liquid to plastic solid. The point of zero yield value is probably dependent on the size of the particle. This concen-

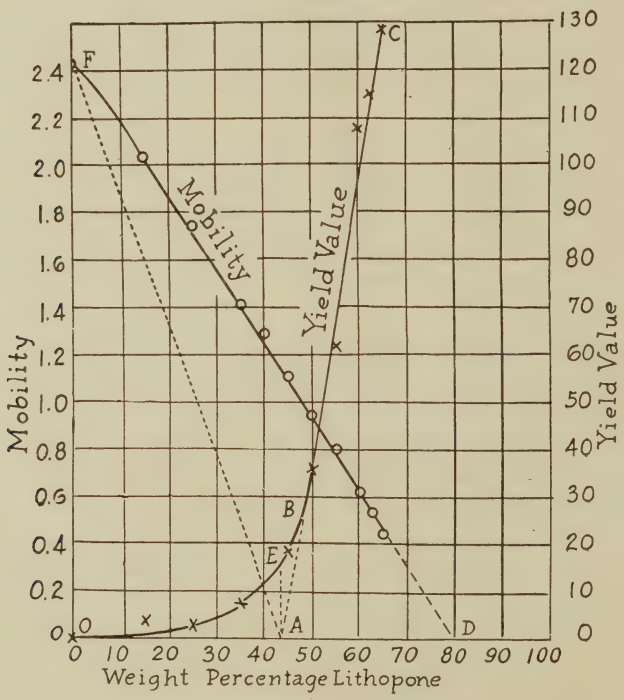

Fig. 1.

tration is of importance as an indication of the adhesion between the pigment and the oil or between the particles of the disperse phase. The yield value-concentration curve is not linear at low concentrations for some reason which is not yet understood, so that the yield value-concentration curve $B\ E\ O$ bends off toward the origin. These yield values are small but they must be taken into consideration. Below the concentration of zero yield value the flow may be spoken of as *pseudo-plastic*.

Mr. Sweely: Mr. Chairman, a question has occurred to me on this. Very often with an enamel which is a clay suspension carrying quite a

large quantity of powdered glass, we have this condition, that the enamel, we will say, runs. And in order to correct that we will add a flocculating medium such as magnesium salts or something of that kind to correct that condition. And the addition of that salt will very often result, if an excess is added, in the enamel becoming quite stiff. Now the quantity of water present will affect the amount of flocculating agent of medium necessary to stop the enamel running. In other words, a very small amount of flocculating medium or what we call a rather dry solution (that is where the water content is low) will bring about exactly the same effect as if the solution was high in water and we had a rather large amount of flocculating medium.

I was wondering how that would work. For instance, in the manipulation of our enamels if we were dipping enamel with high content of water we would have a rather large amount of magnesium sulphate to set the enamel up. Obviously we would not get as much glass onto the piece of ware (and that is the thing we are after) as we would where the enamel is dry and the flocculating medium is added.

Dr. Bingham: The fact that the enamel becomes stiff on adding magnesium salts indicates that there is a large increase in yield value. It is quite possible that the mobility is changed but little.

Thus in a lithopone suspension made up in mineral oil Jacques found that 0.2% of oleic acid lowered the yield value 80%, without affecting the mobility.

It is highly desirable that some one take a series of clays or enamels of different plasticities as measured by practical tests and determine how great a correlation there may be with the yield value or mobility or both.

In paints it was found that most paints are made up to have the same yield value without any regard for the mobility. In these enamels the opposite *may* be true. The clay is added, if I am correctly informed, so that the enamel will stay on the ware which would indicate that a high yield value is desired. Possibly the mobility is of little or no moment in this work. Exact measurements alone can answer.

Mr. Poste: It was mentioned that one of the problems in connection with flat surfaces was apparently this very one. I am wondering if it would be too much to hope for a curve of yield point versus mobility for a given type of work, establishing a proper curve and then feeling reasonably sure that if you get a combination of water content and setting up (as Mr. Sweely has spoken of) that that will bring your relation of yield point to mobility on a predetermined point or curve, thus giving reasonable assurance of good working qualities. It seems to me that that would be possible on a thing that is standardized like the table top industry.

Dr. Bingham: In our investigation of paints we tried to establish some relation between the yield value and mobility. As stated, what we found

was that in general the yield value fluctuated within a very narrow range. If in enamels the yield value must also have a certain value, either by the use of flocculating agents or otherwise, the solution of the problem will be simpler than is suggested by Mr. Poste.

If on the other hand the yield value and mobility are both to be specified, it is quite possible to specify the arbitrary limits for each one. I am inclined to believe that the yield value is the important thing in enamels as in paint, because the yield value is necessary to hold the enamel on the ware.

CHAIRMAN STALEY: That is what I understand. The yield value is the deciding factor and the mobility may go up or down as it may, but it has no effect on the dipping qualities of the enamel.

DR. BINGHAM: That may be the case.

MR. LINDEMANN: In dipping paints, especially in panning, I notice that the painters use hydrometer tests almost exclusively. I have been wondering whether that test was a correct one for them to use, and also whether the hydrometer test would give an indication of our enamels.

DR. BINGHAM: The hydrometer gives the specific gravity from which the concentration can be calculated from the specific gravities of the components. If the plasticity curves of Fig. 1 were known by preliminary investigation of the materials, it is obvious that a determination of the specific gravity would be sufficient to fix the yield value and mobility. But unless the degree of flocculation is always the same and the particle size obtained on grinding as well, one could not depend on being able to calculate the yield value and mobility from curves as in Fig. 1.

MR. LINDEMANN: The reason I am bringing that out is that practically all the japanners have used that for years. When they buy japan it is pretty thick and they thin it down with benzine. If it is too thin, they will put a little more japan in until they get the same hydrometer reading that they have used before. And they seem to have successful results. It may not be correct but it does the work.

CHAIRMAN STALEY: I may say that our use of hydrometer readings in connection with the work of enamel slips has not proven satisfactory.

MR. SWEELY: That has been my experience also. The hydrometer would enable us to predict the yield value and mobility in an enamel if we did not flocculate the clay. It is the flocculation of the clay that interferes with the use of specific gravity. I have tried repeatedly to standardize enamel by taking specific gravity of the enamel slip. But as soon as you add a flocculating agent the whole series of specific gravity tests are upset.

H. D. CUSHMAN: I would like to ask Dr. Bingham whether there is an apparatus in existence which would enable the enameler to quickly determine the status of his enamel. We have been trying for about a

year to develop an apparatus that would give us a certain fluidity. If a man could quickly determine in the plant whether his ground coat was in proper status, that would be a good thing.

Dr. Bingham: Mr. Cooke has obtained very good results with his very simple apparatus. Possibly that is not quick enough. We have been experimenting at Lafayette on measuring the time required to fill different portions of a long capillary tube under a constant pressure. A plasticity measurement can be completed in a few minutes and a fluidity can be measured in a few seconds. But no effort has been made to adapt the instrument for plant use. Eimer and Amend are selling a plastometer but it is not as simple or quick to use as the forms described above.

Mr. Cushman: Will the fineness of grinding have a very changeable effect on that apparatus?

Dr. Bingham: Fineness of grinding as well as flocculation have a very great effect on plasticity. But I believe that the apparatus can be used with a considerable range of particle sizes. The material should be screened to take out coarse extraneous material.

Chairman Staley: Enamels are ground sometimes to pass a sixty-mesh sieve and sometimes to pass a two hundred-mesh sieve, although the concentration by weight is the same.

With any diagram or standard such as Mr. Poste has suggested, the fineness of grinding should be specified as well as the concentration.

Mr. Tyler: A very important factor in the matter is to find some way to stabilize enamels in the slushing pan. I think if the matter of grinding were given serious consideration in its relation to the fineness of the enamel we would get an answer to this question. We all know that an enamel changes as soon as it is put into the slushing box and that there are no two hours in the day when it is absolutely the same, unless it is being worked with all of the time.

Insofar as paints and enamels are concerned, I think that they are entirely different. You can no more measure them together through the same meter than you can oil and water together.

THE TRANSLATION OF PYROMETRIC CONES TO TEMPERATURES[1]

Mr. Booze: I asked to have this discussion given on the floor not because I had anything to give, but because I hoped to get something out of it. The refractories manufacturers are concerned in the use of cones, not only in firing their ware but in testing it. The cones are used very differently in those two respects. In the first place, they want to control

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Refractories Division).

the heat in their kiln, and that brings up the same problem they have in the other Divisions. With respect to the test for softening point, there is no criticism whatever of the standard cones. The problem is in the correct utilization of the results obtained. Many manufacturers insist on using the fusion point as corresponding to the temperature that their brick will stand in an industrial furnace. We know that that is not true and I doubt if we can ever use the fusion point in that way. It might be possible to determine in a test of long duration where a brick did soften enough to flow and use that data in the manner described. However, this would complicate the test considerably and some data that I have indicate that even the present test requires more careful supervision than is ordinarily given it.

Five samples were sent to each of four different laboratories for fusion point determinations, considerable care being exercised in preparing the samples so that one lot was, to all practical purposes, identical with each of the others. Each of the laboratories to which the samples were sent was experienced in making this test, so that the results obtained may be considered as being representative. On the first sample the fusion point reported varied from cone 32 to cone 33, the second from cone 30 to 33, the third from cone $28^1/_2$ to 30, the fourth from cone 26 to 27 and the fifth from cone 29 to 31. These differences are considerable and while I do not doubt but that each laboratory would be able to check its own results, it is evident that either the test is not sufficiently well defined or that the fusion point cannot be accurately determined within limits of less than two cones. We have found in our laboratory that we can check this determination within a half cone in nearly all cases and for this reason I feel that the methods used in conducting the tests were responsible for the differences noted, but until the conditions are satisfactorily standardized, the inaccuracy of the test should be recognized and proper allowance made either in interpretation of results or in fusion point limits written into specifications.

I understand that the Bureau of Standards contemplates an investigation whose purpose is the determination of the time-temperature relation for the softening point of standard cones. It would be advisable for them to determine and publish an accurate temperature scale for the softening point of the standard cones when the test is carried out at the heating rate specified in our standard methods for tests. There are two temperature scales in use now, neither of which is accurate and which differ considerably. It is rather common practice for manufacturers to give the fusion point of their product in degrees rather than in cones, the temperature being obtained by them by reference to a table after the fusion point had been determined in cones. The temperature which is assigned varies according to the scale used. For this reason a standard scale is necessary in

spite of the fact that the fusion point temperature is accurate only for the prescribed rate of heating.

General Orton: I think that Mr. Booze has well pointed out the fact that to use a cone as a guide in burning clay ware is one thing and to use it as a mode of determining the ultimate fusion point of a ceramic mixture with a view to attaching a temperature tag to the test is quite a different thing. You are all ceramists and chemists and you will know that inherently the fusion point of the mixture of dissimilar minerals cannot be made a very accurate determination of temperature because so many factors enter into it; the size of grain of the mineral, the way in which they react on each other, and firing conditions, all mitigate against exactitude in the process of the solution of one mineral in another. That, after all, is what the softening and bending of a cone means, gradual solution of the minerals in it until the mass becomes more like a fluid than a solid, and bends.

From my own standpoint and after some twenty-seven years of contact with making cones I feel an increasing regret that Dr. Seger in starting this work ever attached the idea of temperature to the use of his cones. I think it would be much better and we should have been farther along perhaps in our appreciation of the case if he had not done so. But the mischief is done; the cone stands before the world in some degree as a mode of measuring temperature and it is too late for us to attempt to get rid of that impression.

I have in all my pronouncements on this subject, advertising matter, and private correspondence, always minimized the temperature idea as much as possible and frankly called attention to the defects of the cone or any similar material as a time-temperature proposition and not temperature alone. I was rather amused and a little chagrined recently to find out that because I had taken that ground so frankly in what I have printed and circulated on the subject that some of the public are interpreting that as a disclaimer of the quality of my material product and imagine that the other is all right. I hardly like to have that inference made.

In the firing of ceramic ware the cones are used as a guide. You are submitting the ware to a comparison against a material in which a similar series of reactions is in process. If you are firing fire brick the grain is coarse and the mineral combinations are slow, but after all it is a process of gradual solution or hardening caused by the solution of one mineral in another and that is what the cone is doing. So that it seems to me to be possible to establish a relationship between the cone where long firing processes are concerned and the slow reaction time is made use of and the similar degree of hardness or stability in the body that you are trying to fire.

It does not mean to say the correct firing temperature in the kiln and the melting point of the cone have any other than a fortuitous relation

to each other but if you find, for instance, that cone 16 gives you a time-temperature treatment at the end of which the fire brick show good physical qualities you will not need to establish any other connection. For that purpose I think the cones serve as well as they do in whiteware or any other.

When you make a fusion test the situation is quite different. The fusion test of a fire brick is a different thing entirely from its actual use. Actual use is strung out over long periods of time usually from a few days to many months and the time factor is more extended perhaps than in any similar case we could illustrate. But when you are determining the fusion point of fire brick you destroy all of that set of conditions. You pulverize the fire brick to a minute powder, prepare a test piece, put it into a small furnace and bring the temperature up rapidly to the point of ultimate softening. Now the cone is doing the same thing and it is possible therefore to establish a fairly exact relationship between the melting of the cone and the melting of this ground pulverized mixture composing the fire brick.

The information thus obtained does not mean that the fire brick could be used at that temperature. The information we have is an arbitrary thing and not very directly translatable into service temperatures of the product. But the trade, I imagine, demands that there be some idea of relative fusibility of fire brick and therefore, to meet that, this test has been devised by fire brick makers and users to get at something to show that one fire brick will actually fuse at a different temperature than another fire brick though neither one of them is actually used at their fusing temperatures; or that the fusing conditions if obtained at all are attained in the long-time reaction, in which the time factor is almost infinite.

I indicated in the early part of my statement that it is unfortunate that the temperature idea is so insistently connected with the use of cones but since it is, the only logical thing to do so far as applying the cone method to the determination of the fusing point of refractory materials and probably to other purposes is to establish under accurately controlled conditions by the best methods available the fusing point of the cone mixture. But you will, of course, understand that if that is done it has to be hedged about with a very exact set of specifications. The cone itself must conform accurately to the size of the crucible in which it is fired, must conform accurately to size, and the wall of the crucible must be just so; the opportunities of radiation of heat by which it is surrounded must be so; the time factors must be accurately controlled both in the preparatory stage of the firing and later. The rate of temperature increase per hour or minute must be known. All of these things have to be done if you are going to tie a temperature tag on the cone. If all these things are done I believe that you will find that the fusing point of the cone can be stated quite accurately and that the cones will come down at that exact temperature.

But that does not mean that somebody else who has not that series of equipment and who is willing to devote that amount of time to the process would get the cone fusion at that temperature.

Of course, the application of the temperature to fusion of refractory cones is somewhat more difficult than it is in a lower series because of the pyrometic difficulties themselves; the various points beyond which you can distinguish with the naked eye what is going on. That is much more difficult.

I do not wish to give you the impression that I think this test should not be made. On the contrary, talking with a number of you I have rather been switched to the point of view that some good results and some educational may be had by going into it. I think those who clamor for the use of temperatures in connection with cones will perhaps gain a truer perspective of the whole subject of accurate comparison being made. It will show how many factors are not now appreciated.

I take the cone somewhat seriously, not as a scientific tool, but as a great practical convenience. There can be scarcely any doubt of that in view of the constant increase in the use of it over a long period of years. Twenty-seven years is quite a while. The curve of use has gone steadily onward all the entire period and does not seem to show any indication of stopping. That could hardly be unless people got a definite value out of it. But the greatest value will be gotten out of it if we realize in the beginning just exactly what it is for and try to use it for that purpose.

In connection with the Bureau of Standards I will coöperate, if allowed, with that organization or with any other organization that the American Ceramic Society wants to utilize in having tests made to show the relation existing between the foreign-made cones and the American-made cones. I am perfectly willing to facilitate that by furnishing materials and advice so that we can establish as nearly as possible the relationship between the different series. I am not very optimistic about any great concrete value coming from such tests. I think you ought to look the facts in the face and use the cone for what it is good for and not attempt to make it do things for which it was not designed.

Mr. Howe: I have felt for some time too, we are well in need of some educational work in connection with the use of cones. In fact the American Ceramic Society on one or two occasions sent small mimeographed copies explaining the strong points and weaknesses of the cones. In the refractories industry more than probably any other, the cones are used to a large degree in the sale of products as well as in the manufacture. We find as we get up to the higher temperatures the published fusion point varies considerably. They agree pretty closely to cone 20, but the old series carries the 20 °C jump whereas the new ones have a 50 °C jump between cones so that they will vary approximately 70 °C. It really places the progressive manufacturer to a disadvantage.

A progressive man, you might say, having a product fusing at cone 32 can go out and say his product fuses around 3100°F, but the man using the old scale and having a brick fusing at cone 30 can go out and cite 3218°F, a difference there of 118°F. So we have tried to bring that point out and familiarize manufacturers with that discrepancy.

I believe in the application of the cone fusion test results. They go to their customer who has a report of 3218°F. (That is a familiar one.) He will immediately know that is cone 32 on the old scale and he can translate it in terms of the newer scale if he is using that. Another thing we have tried to bring out is the fact that the whole temperature scale at the time the older values were assigned was considerably higher than it is now. I believe that platinum was one of the standard points several years ago and it was considered as melting at 50° or 60°F, higher than it is considered at this time so that the whole upper range has been thrown off for that reason.

Coming back to the purely manufacturing standpoint I do not believe that there is anybody using pyrometers who does not check them or the cones with the pyrometers. It seems to me if a set of well standardized time-temperature curves were broadcasted to users of cones, it would at least show that the time was as great a factor almost as the temperature. By having a set of curves perhaps corresponding to the rate of heating up fire-clay brick which is fairly uniform and then going to fairly standardized period of oxidation which is not so great in this industry, that a man could find some curve there that would nearly hit his condition. If he insisted on knowing his kiln temperatures he could estimate it more reasonably than he can at the present time.

It seems as though rather than trying to get specific information along these lines that the educational work suggested by General Orton is a thing we ought to back up and as soon as possible for the benefit of the man who really wants to learn their advantage.

Chairman Harvey: I think Mr. Booze brought out the point from which the difficulty arises. If we only had one scale of temperature attached to cones, it would not make any difference what it was. We would speak the same language. Most of us appreciate the limitation and advantages of cones for measuring heat values and the trouble we are in is that one manufacturer and consumer specify a certain temperature which we have to translate into terms of cones and we do not know what scale they are working on. So if we can bring about a standardization which will be adopted by both the manufacturer and the industry as a whole, personally I do not think it makes any difference what it is—whether it is direct or indirect. So long as there is one of them, the cone number is as good as anything else.

DISCUSSION ON "IMMISCIBILITY IN HIGH SILICA MELTS"[1]

By J. W. Greig

Dr. Bowen: Hitherto the glass making oxides have for the most part been regarded as completely miscible. It is not so long ago that some glass makers thought that the lead-rich layers forming in the bottom of pots of flint glass were due to immiscibility but I do not think that anyone would urge that now. They are due to differential melting and settling of a heavy liquid not yet mixed but when it is mixed in any way it will remain mixed.

What I want to speak of now is a different matter—something that will not mix, just as oil and water will not mix. The story of this investigation goes back several years to a time when I myself was investigating the system, magnesia–silica. In that work it was found that in very siliceous melts the liquidus of cristobalite rose very steeply and suggested a very high melting point for cristobalite. Later Ferguson redetermined the melting point of cristobalite and found that, while it was considerably higher than had been supposed, it was not as high as the steep liquidus suggested.

On account of the temperature limitations of the platinum furnace the cristobalite liquidus had not been followed above 1650°C in any system. Several systems investigated showed the same very steep cristobalite liquidus, which fact, taken in conjunction with Ferguson's value for the melting-point of cristobalite (1710°) proved that the liquidus of cristobalite in all these cases must flatten in a very remarkable manner in compositions close to pure silica or that the liquidus is actually discontinuous as a result of the formation of two immiscible liquids. Having a platinum-rhodium resistance furnace at our disposal which would enable us to work at temperatures above those attained by the platinum furnace, it was decided to investigate the exact shape of the cristobalite liquidus at the higher temperatures where it had not hitherto been studied.

As a result of this work it was found that in some systems there is indeed a discontinuity in the cristobalite liquidus, due to the formation of two liquid layers. The systems in which the exact form of the cristobalite liquidus has been determined are the following: $CaO–SiO_2$, $MgO–SiO_2$, $SrO–SiO_2$, $BaO–SiO_2$. In each of these except the last it has been found that there is a high silica region in which two immiscible liquids are formed. With BaO there is a remarkable flattening of the liquidus but immiscibility is not shown.

A preliminary examination of the systems, $Na_2O–SiO_2$ and $K_2O–SiO_2$ has also been made and, while the full details of the shape of the liquidus

[1] Presented by N. L. Bowen at the Atlantic City Meeting, Feb., 1924 (Glass Division).

of cristobalite in these systems is not determined, enough has been done to show that there is no region of immiscibility.

Dr. Insley: Could you imagine such a case in which the silica liquid was the dispersed phase and the low silica was the dispersion medium?

Dr. Bowen: I can imagine such a case but we have never found it. Probably it has something to do with the surface tension phenomena. Even when we have a very large excess of the lime phase it occurs as globules, with thin films of the other phase.

DISCUSSION ON "THE SYSTEM Al_2O_3–SiO_2"[1]

A. A. Klein: I think this paper is an exceptionally fine contribution. The Norton Company have been doing quite a little work with alumina-silica fusions of the general composition of sillimanite. When working to the ratio $Al_2O_3.SiO_2$ with the purest raw materials we had, we invariably ran into crystalline material, supposedly sillimanite, containing 6 to 10% glass. This did not seem of particular significance because glass has been reported as a usual constituent of artificial sillimanite. However, within the past few months, we have been working with compositions on the high alumina side of the $Al_2O_3.SiO_2$ formula. For instance, a fusion with a composition of 75% Al_2O_3 and 25% silica should give on the basis of the $Al_2O_3.SiO_2$ formula an excess of corundum equal to 30%. As a matter of fact, we estimated not more than 2–3% of crystalline alumina present. We first thought that the analysis of the batch was wrong but in checking up the analysis it was found correct. We were, therefore, led to the assumption that there existed either a solid solution of alumina in sillimanite or else that artifical sillimanite was not $Al_2O_3.SiO_2$ at all but of a composition richer in alumina.

About that time Dr. Bowen presented a paper at the Geological Society which practically cleared up the whole situation, indicating the existence of $3Al_2O_3.2SiO_2$ and showing that so-called artificial sillimanite was of this composition rather than that of the natural mineral, *viz.*, $Al_2O_3.SiO_2$.

Prof. Wilson: As I brought out this morning in discussion of the paper on sillimanite, our work in melting batches of sillimanite in the electric furnace in 200 or 300 pound lots has checked up with Dr. Bowen's results very nicely. We have found, however, that the $3Al_2O_3.2SiO_2$ sustaining melting incongruity is hardly checked up by our results. We have produced a great many ingots of that composition and of higher Al_2O_3 and in no case have we found any corundum.

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[1] See N. L. Bowen and J. W. Greig, *Jour. Amer. Ceram. Soc.*, 7 [4], 238(1924).

DR. BOWEN: It is all liquid, then cooled. Crystallization may not begin until you get down to $3Al_2O_3.SiO_2$, in which case you get corundum. You have to hold it for a considerable time to get the desired form. We always work in that way until we obtain the equilibrium.

PROF. WILSON: In making a big melt it cools comparatively rapidly. Would you expect us to get any corundum at all until the mixture is well above the $3Al_2O_3.SiO_2$ ratio of alumina?

If that sustains melted incongruity it would not act as a pure chemical substance and melt down from the sides but it would tend to slump more or less. In our tests we have always found that $3Al_2O_3.2SiO_2$ would also melt down as a cake of ice—melt down from the sides. The cone would actually melt away at the melting temperature, whereas if the material melted along that cooling curve you would get a series of liquids supporting solids and it would be a case of slumping rather than actual melting. In that respect only do our results not bear out your large scale experiments.

DR. BOWEN: When you heat or cool a thing very rapidly you need not get the equilibrium conditions. Very much more melting will go on than does go on at a given temperature.

PROF. WILSON: As I understand it, your 3 alumina 2 silica combination is not a chemical compound.

DR. BOWEN: There are many other types of compounds that have this incongruity. Not only do you get alumina in that 3 to 2 combination —you get it in the one to one. You get natural sillimanite.

PROF. WILSON: Starting lower than one to one, and bringing the alumina up and above three to two, we do not get any corundum, but when we have gone above the two to three ratio, the corundum appears.

DR. NAVIAS: Has the viscosity of the SiO_2 and Al_2O_3 mixtures been determined? Of course the viscosity will greatly influence the time element sufficient for the formation of crystals.

DR. BOWEN: We have tried to make glasses of these mixtures for the purpose of determining their viscosity partly to know what they are and partly to determine the composition of their liquid phase, sometimes a very useful thing. We find it impossible to cool the glass rapidly enough to prepare a glass beyond the one to one proportion. We have prepared glasses of silica and on over in the neighborhood of one to one composition making a very minute amount and letting it fall under the furnace. Beyond the one to one ratio you cannot cool rapidly enough even to get it to glaze. The viscosity affects the crystallization very materially and the rate of crystallization indicates the viscosity increases regularly from the point one to one and presumably over to an alumina. It may not be a linear change but certainly there is a general increase in the viscosity going toward silica, a decrease in going over to alumina.

MISBRANDING RAW MATERIALS AND CERAMIC CHEMICALS FOR GLASS MANUFACTURE[1]

Dr. Silverman: My attention was first called to misbranding during the war, although it had undoubtedly existed for many years. I happened to be at a glass factory at a time when a beautiful specimen marked "Nitre Cake" was brought in and placed on the president's desk and he decided at once that he was going to order some since the dirty looking South American nitre was very scarce and costly and he could get this for two cents a pound. I told him if he would send empty freight cars to some of the nitric or hydrochloric acid plants that he could get all he wanted by paying the freight; that it was not nitre, that it was a by-product of the nitric acid industry, and that if he ever introduced it into a pot of lead glass he would regret the day he began the experiment. I have been on the watch for such cases ever since, and in the course of my work during the last five years have run into a number of materials which were misbranded.

One of the worst acts in the whole lot is the selling of an article which is called synthetic "cryolite," which, according to analysis contains fluorspar, sodium silicofluoride, feldspar and quartz or sand. It sells at about six and one-half cents a pound and there are a lot of gullible manufacturers buying it. One of the members of the Glass Section of the Society said that it serves the manufacturer right if he pays the price for this material instead of having a chemist in control of the work in his plant.

In a single instance, where we made the anlaysis and substituted the materials themselves instead of buying synthetic "cryolite," so-called, the cost per pound was reduced from six cents to two cents, and the saving in a single glass, of which only three or four pots were made per day, was over $5000 per annum. You can get a pretty good chemist for that sum and the glass manufacturer ought to realize what the purchase of such material means.

There is another preparation which is sold together with formulas for the making of the glass, which contains plaster of Paris, sodium silicofluoride and feldspar. It also sells at six and one-half cents to seven cents a pound. There was also an earlier mixture, known as Opaline, which brought a good price.

I do not know that we can object to the sale of a material or a mixture of materials under a trade name because that is business for the fellow who is clever enough to put it over, but we certainly can object to the misbranding of an article put on the market as cryolite that contains no cryolite. I believe that the American Ceramic Society ought to go on

[1] Presented at the Atlantic City Meeting, Feb., 1924 (Glass Division).

record asking for the enactment of a law governing commercial chemicals, in much the same way as food products are governed by the Food and Drug Law.

Dr. Shively: This suggestion of Dr. Silverman is really a fine one. I have visited glass plants and have had occasion to get in their mixing rooms and find out what they have. You would be surprised to know the number of them that have fallen for these so-called preparations, that as has been explained are being exploited. You would be surprised to know how many people have bought them and have never tried them out. They buy them, influenced by the salesmanship of the man selling them, and after they get them, they put them aside to be used some time later.

Dr. Shively, Dr. Silverman and Mr. Blau were appointed to write out the resolutions and reported as follows:

Resolved: That the Glass Division of the American Ceramic Society urge the United States Government to enact a law similar to the Food and Drugs Act, controlling interstate shipments of ceramic chemicals for the purpose of preventing misbranding and adulteration of said chemicals and raw materials. Further, that other Divisions of the American Ceramic Society be asked to take similar action leading if possible to a resolution to be presented by the National Society.

Mr. Modes: What does that cover?

Chairman: Ceramic chemicals.

Mr. Modes: What compounds do you expect to control?

Dr. Shively: That controls, as I understand, all raw materials and chemicals that enter into the manufacture of ceramic products. I might say that since this resolution was drawn I found out through a representative of one of the large houses here that there is already a law which controls misbranded interstate shipments, providing anybody wishes to push it.

Mr. Modes: It is not expected to cover a man who makes a compound or a preparation?

Dr. Shively: No.

Mr. Modes: If he ships feldspar and it is sold as that and not under some mysterious name?

Dr. Silverman: If a man wants to sell something under a trade name and the glass manufacturer wants to buy something under a trade name, that is not covered by our Resolution, but he cannot sell a mixture of substances which do not contain cryolite as synthetic cryolite. Synthetic cryolite has a definite composition and it is supposed, according to the specifications of Grünwald and others, to contain a certain percentage of cryolite. If he wants to sell something under a trade name, for instance, Opaline, that is his business. He is selling a mixture for coloring some ceramic product but he cannot call it cryolite if it is not cryolite.

If an act already exists which covers this, our resolutions should be changed urging the enforcement of that act rather than the creation of a new one.

The resolution was amended as follows:

RESOLVED: That the Glass Division of the AMERICAN CERAMIC SOCIETY urge the United States Government to enact a law, or enforce one if already existent, similar to the Food and Drugs Act controlling interstate shipments of ceramic chemicals and raw materials for the purpose of preventing misbranding and adulteration of said chemicals and raw materials. Further, that other Divisions of the AMERICAN CERAMIC SOCIETY be asked to take similar action leading if possible to a resolution to be presented by the National Society.

Resolution carried.

DISCUSSION ON "CONDUCTIVITY OF SODIUM CHLORIDE IN SODA LIME GLASS"[1]

MR. GREENE: May I ask if the glasses melted showed any signs of opalescence?

DR. SILVERMAN: The glass was not an opal glass at all. It was a crystal glass.

MR. GREENE: The chloride had no effect in producing opalescence?

DR. SILVERMAN: No, there was no opalescence except in a few instances where there was a small amount of devitrification around the electrodes. We attributed that to unusual conditions and in those cases the determinations were discarded. In the majority of instances we had a clear melt and there was no devitrification. We found when we got beyond 1.41% sodium chloride content that the salt would form a separate liquid layer and then the results had to be discarded because we were getting the conductivity of the fused salt as well as that of the solution in glass.

DR. SHIVELY: I come in contact with a number of opal manufacturers who use calcium sulphate. They claim that it has some effect in increasing their opalescence. In this work of yours did you find that the presence of electrolysis had any influence on that?

DR. SILVERMAN: I have found in research on opal and alabaster glasses that the moment you introduce chloride or a sulphate there is that effect. There is a tendency to precipitate a certain amount of material and increase the density of the glass. Of course, there are various theories that have been advanced. One is what we were trying to prove here, that salts in solution in the glass ionize and precipitate the colloid. The other is that it is entirely an oxidation phenomenon and the latter has some support. For example in an investigation that was conducted a few years

[1] See Willard J. Sutton and Alexander Silverman, *Jour. Amer. Ceram. Soc.*, **7** [2], 86(1924). Discussion presented at Atlantic City Meeting, Feb., 1924 (Glass Division.)

ago an alabaster glass that was left in the pot long enough to become crystal lost color entirely. At the suggestion of a workman in the plant we played a stream of air on the surface of that glass because we were told that the air would cool that glass down and that when it was melted again it would be alabaster. It seemed incredible that a thing like that should happen as it did. I looked over all of my batches on opal and alabaster glasses to see whether oxidation played a part. There was not one batch in which we did not employ an oxidizing agent. If we used sulphates at high temperatures as oxidizing agents when the chlorides were used alone we got no opalescence, and no alabaster effect unless nitre was introduced or some other oxidizing agent. Even with a chloride and an oxidizing agent there is the possibility that the increased opalescence is the result of oxidation and not the effect of electrolytes in solution.

Mr. Payne: I was trying to find a substitute and an improvement over arsenic as a clarifier. We tried potassium chlorate in small quantities and substituted in a small experimental tank a bleaching powder, calcium oxychloride. We put in all of the CaO which ran to about 8% of the total in the form of oxychloride with no sign of opalescence resulting.

Dr. Shively: A number of manufacturers in making flint glass use as high as 25 pounds of sodium chloride to a thousand pounds of sand. They claim it prevents the formation of scum. I know of one place where every manufacturer in that immediate district used sodium chloride. There is a lot of sodium sulphate being used to prevent scum but in one particular location a number of them used sodium chloride.

Dr. Silverman: Is the temperature high enough to drive off the salt?

Dr. Shively: 2700°F.

Dr. Silverman: I should think they would find it difficult to drive off salt; it would create a high tank corrosion.

Dr. Shively: They are doing it right along. They are using it regularly in one locality. It seems that some man tried it out and found that it gave him good clear glass and free from scum. He notified the other people in that immediate vicinity about it and they are all using it now.

Dr. Silverman: Of course, you have an advantage in the use of floats in a tank. Any chloride layer on top stays out of the working end of the tank, but you can hardly get over $1^1/_2$% sodium chloride into solution and the surplus is going to form a liquid on top like oil on water.

Dr. Shively: Twenty-five pounds of chloride would not be a great amount to 1000 pounds of sand.

Dr. Silverman: You are beyond the sodium chloride solubility limit, you will find.

A Member: You speak of the solubility limit on sodium chloride in such glasses. That varies with the temperature. You speak of 1.41. Can you give us any idea at what temperature that holds?

Dr. Silverman: The curves show the conditions under which the experiments were run. The maximum temperature in this particular series was 1100° to 1150°.

A Member: And then that figure holds at the maximum temperature?

Dr. Silverman: Yes, it holds at that temperature. We actually found a salt layer on the surface of the glass when we got beyond 1.41%.

A Member: Does the solubility decrease with temperature?

Dr. Silverman: It becomes slightly less, but this was the greatest amount we could introduce at any temperature within the limits of our investigation.

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

Questions

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire clay to spalling?

2. What difference is there between the properties of a soft mud machine-made and a hand-made brick?

3. Can an iron-free clay brick be made for blast furnace service?

4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?

5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in burning of low refractoriness?

6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand-made fire brick?

7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?

8. What is the reason for the more rapid failure at a lower temperature of fire brick subjected to reducing atmosphere than will obtain with the same brick under oxidizing conditions?

9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

10. At what temperature does fire clay break down into sillimanite and quartz? Are the crystals thus formed actual sillimanite or are they the newly discovered mineral $3Al_2O_32SiO_2$?

11. What properties should a clay brick possess to give good service in rotary cement kilns?

12. What properties should a clay brick possess to give good service in vertical shaft lime kilns?

13. How can the water content for wet pan charges be gaged?

14. What simple laboratory tests can be used to keep the quality of refractories up to standard?

Question

At what temperature does fire-clay brick break down into sillimanite and quartz? Are the crystals thus formed actual sillimanite or are they the newly discovered mineral $3Al_2O_32SiO_2$ which has been called mullite?

Discussion

"In general number 1 fire clays dissociate into aluminum silicate and glass. The probable composition is $3Al_2O_32SiO_2$. The temperature at which crystals of the latter appear distinctly enough so that they can be distinguished optically, ranges from somewhat under 1300°C to above 1350°C.

"Concerning the composition of aluminum silicate, our experience with fusions of the products running high in so-called sillimanite compositions verify the work of Bowen and Greig.[1] We assume that their findings hold true in porcelains and in fire-clay refractories.

"Our experience has been that the formation of this crystalline constituent progresses during the service of the brick under high temperature conditions. In no case, however, unless there be the fluxing action materials introduced extraneously, do the crystals of aluminum silicate grow to a large size and to perfect development."—A. A. Klein, Norton Company. From joint notes of Herbert Insley and A. A. Klein.

Hewitt Wilson states that Bowen and Greig have answered the question regarding the composition of the aluminum silicate formed in fire clays under high temperatures. His letter proceeds as follows: "We have no data on the development of mullite in fire-clay brick for we have been working with purer materials carried to melting temperatures in the electric furnace. We did get the mullite-corundum crushed fragments to re-crystallize as low as cone 20 in an oil-fired furnace.

"We do not believe that the development of mullite in the ordinary fire-clay brick has much effect on the internal structure of the brick because the quantity of crystalline material is too small to produce strength by an interlocking of crystals when compared to the amount of amorphous material plus fused glass.

"Mullite crystals will form in high temperature silicate fluids, such as the Orton cones, or at low temperatures in such liquids as melted PbO, provided the alumina-silica ratio is high enough. Crystalline glazes can be produced by making a super-saturated solution of mullite in PbO glass."—Hewitt Wilson, Univ. of Washington.

Question

What is the relation of this formation of $3Al_2O_32SiO_2$ and silica glass mentioned by Bowen and Greig to the condition seen in fire brick after long service in high temperature

[1] N. L. Bowen and J. W. Greig, "The System Al_2O_3–SiO_2," *Jour. Amer. Ceram. Soc.*, **7** [4], 238; **7** [5], 410(1924).

brick kilns and flues, when the greater portion of the brick appears to be black glass with occasional white flint clay grains or quartz particles?

Discussion

"The black glass found in fire brick after long service at high temperatures often contains mullite crystals but unless the latter form a thick coating on the surface to retard slag attack, they cannot be of much importance. In our tests with purer materials, even small amounts of glass produced 'internal lubrication' of the crystalline structure and we believe that this accounts for the ear slumping of the first artificial 'sillimanite' refractories."—HEWITT WILSON, Univ. of Washington.

"The condition where the brick appears to be a black glass with occasional white flint clay grains or quartz particles seems to us, without having examined the product, to be a case of fluxing, probably as a result of reaction with constituents of the combustible. We have had occasion to examine the back of a fire-clay piece in contact with an oil flame for a long period of time. This was coated with a milky white vitrified substance which was found to consist of a clear glass containing well-developed sillimanite needles. In this particular case the flux was soda, which was found in very small amounts in the oil."—A. A. KLEIN, Norton Company. Further discussion of these questions has been solicited but is not now ready for publication. Those readers interested are requested to contribute to the discussion for an early number of the Question Box.—Ed.

Question

Will results in service justify the use of super-refractory brick, and the added expense necessary in the proper fabrication of such a refractory?

Discussion

The following extract from private correspondence with a furnace engineer and designer gives some figures and reasons why a super-brick is desirable in certain cases.

"There are a number of water-cooled ports used in open hearth furnaces in this country and none at all in Europe. The ports are extremely expensive and require considerable attention. They wear out rather frequently. The only reason they are used is because when ordinary fire brick of the best grade are used it does not permit the forcing of the furnace which is so much desired in this country. For example, if an O. H. furnace costing, with all the equipment that goes with it, about $1,000,000 can be forced so as to yield 25% more steel per year, the investment of $1,000,000 will yield a gross income 25% greater but a net income of probably 50% greater. The cost therefore of a high grade fire brick is not an important consideration in comparison to its value if it will do the work.

"In certain other types of furnaces we would arrange the ports and the combustion chamber in a more efficient manner if we could get refractory materials that would stand the service. We are continually modifying our designs so as to meet the limitations of the fire brick we have to use. Then again in certain types of furnaces where the heat is extremely high, in fact in almost all types of furnaces where the temperature is over 2700°F we are obliged to use a crown that is but nine inches thick. We do this so that a large portion of the heat will be wasted by radiation and leakage through the roof and thus prevent the hot side of the roof from becoming over-heated. If we could get a brick that would stand 3000° continually we would build the roof with an extra rowlock of brick over it to hold the heat in. Our furnaces would then be more efficient. In many cases it would save at least 10% of the fuel. This of course would amply justify the use of an expensive fire brick."

Question

What properties should a clay brick possess to give good service in lime kilns?

Discussion

"To cover the matter of lime kiln linings a discussion of several pages in length would be required. Briefly, there is to the writer's knowledge no one type of refractory which is best suited for all types of lime kilns. This is represented in a great variety of service conditions such as, method of firing, kind of fuel, kiln output, temperatures obtained, analysis of stone, kiln design, etc. For instance, for a shaft kiln, we are apt to find different refractory service requirements for the fire box and the burning zone, which is a variable in the kiln itself, and again refractory requirements may vary from kiln to kiln, depending upon whether the furnace is hand fired or gas fired.

"There are also types of vertical lime kilns in which the kiln is fired not by having fire boxes at the base, but by mixing coke with the charge and the combustion takes place in the main chamber proper. Briefly the matter of refractories for vertical is covered as follows: The chief requirement of the lining for the upper zone is that it resist abrasion or wearing action of the stone and that it be only moderately refractory. For the portion of the kiln extending from eight to fifteen feet above the fire box, the brick must necessarily be of high refractoriness, at the same time showing good mechanical strength and resistance to abrasion, and also have a moderate resistance to spalling action.

"Under certain conditions, where either the stone is somewhat impure or where very high temperatures are obtained, it is often economical to use a high alumina type of liner, which is more inert to the chemical action of the charge.

"With respect to the rotary type of lime kiln, the lining for both firing and cold zone must resist abrasion or wearing action and the lining in the firing zone is, perhaps, on the whole, subjected to higher temperatures and to more severe chemical action than is true in the case of the vertical kiln. This fact has led to the extended use of the super-refractory of high alumina type of rotary hot zone liner in the lime industry.

"The whole problem, therefore, of refractories for lime kilns dissolves itself into the matter of analyzing each service condition."—L. C. HEWITT, Laclede-Christy Clay Products Co.

Question

What is the cause of the swelling of fire brick in the hearth of a lead blast furnace after the furnace has been blown out and is allowed to stand idle?

Will a high alumina brick resist metal absorption in a lead furnace? If so, what is the minimum alumina content required in such a brick?

What is the best type of refractory brick for lead blast furnace work?

Discussion

The following data is submitted to give the preceding question on lead furnace refractories a background and does not attempt to answer or discuss them. The information was secured from an operator of a battery of lead blast furnaces. The furnace construction includes the customary fire-brick hearth, water cooled jackets at and above the tuyères, and a fire-brick stack of rectangular cross-section.

Some years ago considerable experimental work was done in re-lining the furnaces to find a refractory which if possible would cut down the metal absorption. It was felt that if some such brick could be found it would pay to use it even though the first cost of the brick were high. The highest absorption occurs in the lead crucible and is apparently unavoidable on account of the great weight of metal contained. In addition to the mechanical difficulties introduced by the expanding brickwork, the re-smelting cost and the interest charges on precious metals tied up in the lining is quite an item. There is more or less slag absorption above the metal line and in the slag pocket.

In the search for a non-absorbent refractory many brands of first grade brick from all sections of the country were secured and installed in the most painstaking manner. Accurate records of the weights of all brick used were made, both before installation and on tearing out. No apparent difference in lead absorption was noted in any of the brick per unit of weight.

After trying several brands of first quality and a few brands of intermediate duty brick, one product was selected as giving promise if it were ground finer and fired harder. Accordingly brick were secured which were made by three different processes (dry press, stiff mud, hand made repress), the

ingredients being finely ground and the brick fired very hard. These three types of brick were installed in the same lead crucible together with hard fired, coarse grind, grogged brick regularly furnished by this manufacturer, a quarter of the lining being made up of each kind of brick. At the end of the run a few whole brick of each kind were removed. There was no apparent difference in the amount of lead absorbed by any of the brick.

Brick tested in the first general investigation included some from the Missouri, Kentucky and Pennsylvania fields and were nearly all made from normal fire clays. No alumina content higher than 35% was noted. Some intermediate duty or low duty brick with silica content ranging from 60 to 72% were also used. The cheapest and most accessible brick is now in satisfactory use and there appears to be no reason for making a change unless further test of the recently developed high alumina brick should show an advantage over the cheap brick in service. The following analysis is typical: SiO_2 69.6–, Al_2O_3 24.6–, Fe_2O_3 1.3–, CaO 1.9–, MgO 1.6–, loss 1.0–, fusion cone 29–30.

Fire brick swell considerably as they absorb metallic lead making necessary a more or less flexible expansion joint between the water cooling jackets and the stack. This consists of two courses of reversed wedges of magnesite brick which permits adjustment. The stack must be self-supporting. As soon as the expansion joint is closed entirely the hearth must be rebuilt and the smelting zone relined.

When the brick have become completely impregnated with lead there appears to be no tendency for the metal to go through to the wall or jacket as in the case of copper penetration, but the brick continues to swell and absorb more lead.

If a furnace is operated for several months until the brickwork is filled with lead, then blown out and allowed to stand idle for a time, the hearth and lining will continue to swell and puff up. If allowed to stand long enough the expansion joints would gradually close up tight and require a rebuilding of the furnace. The brick do not go to pieces, probably on account of the complete impregnation with lead which being ductile allows the further expansion without rupture, and the furnace may be blown in again if required provided the expansion joint is wide enough to warrant it.

Metallurgical coke is used for fuel, which is mixed with the charge of roasted ore. About 30% of scrap iron is added to the charge to facilitate the melting.

Discussion of the questions listed above is solicited.—Ed.

ACTIVITIES OF THE SOCIETY

PRESIDENT'S PAGE

By Robert D. Landrum

An American Ceramic Institute

Since last May, when the idea of the Ceramic Institute was first presented on this page, much advancement has been made. However, the Ceramic Institute as it stands today is still only an idea, an idea entirely different from what it was a month ago, and quite different from what it was several months ago. Very probably it will be very different from what it is now, after we discuss the matter at the Columbus meeting next February. Any detailed propositions which have been made have been given so that we can discuss the matter. The Ceramic Institute idea is to find some method of organization so that a real research program can be financed and carried out without duplication.

Every function of this Society of ours revolves around one fundamental purpose: to bring into one organization all the men who are striving to improve the products of the silicate industries, and to provide for them the advantage of benefiting by the experiences of their fellow workers through personal discussion at our meetings, and through the formal papers given in our publication. At first a very simple organization was satisfactory. At the Section Q meetings, practically the whole membership could sit at one table, but as the scope of our activities expanded, division into groups was necessary, and we have today the advantage of seven technical societies represented by our Divisions, held together in one well-knit organization, with the committees so interwoven that there is no duplication of activities. Our organization is successful, for we have, at a very small general expense, so guided our activities that the results are astounding.

No country in the world can boast of accomplishments such as ours in the ceramic field, and, without doubt, it is due to our organization in this Society. We are at the point now, though, where it is very necessary that some arrangement be made whereby research in our industries can be initiated according to a definite program. Up to this time, the research which has been done has been initiated by our individual members, and for the most part, has been merely reported at our meetings and in our publications. The American Ceramic Society is the organization which can most quickly bring into being a Ceramic Institute today to do this very thing.

Although the interests of all the silicate industries are very closely allied, and a great deal of the research which should be done is fundamental to each and every one of the industries represented, still a large portion of the problems fall very naturally into groups which are represented by our different Divisions. Therefore, I feel that the Ceramic Institute should be a federation of several specific Institutes.

The Clay Products Institute is already being organized, and care should be taken that this does not become so complex that individual initiative is hampered. There should also be formed a Glass Institute, a Terra Cotta Institute, a White Wares Institute, and an Enamel Institute, each of these centralized in the Ceramic Institute. The organization of these specific divisions can be initiated by the trade associations of the industries represented, or by the Divisions of our own SOCIETY in collaboration with these trade associations.

In any plan that can be evolved, there must be a research head, a salaried man to coördinate all of this work and to see that the fundamental work which is useful to each and every separate Institute is done and not duplicated. This man should be definitely connected with our SOCIETY. Such a man would be in the position to determine just what part of the work could be done in the individual plants interested. He would determine what work could be done in laboratories such as can be found in the various schools. This would mean the establishing of more Fellowships. He would know the facilities of the various Government laboratories, and determine what part of the work could be done in these. He would lead in the formulation of a research program and see that this was carried out. He would be the research director of each of the separate Institutes, and head the committee on research in our SOCIETY.

The AMERICAN CERAMIC SOCIETY has a big job ahead of it in guiding this tremendous idea. Research as we know, does cost money, but we know, too, that research properly guided probably yields the largest returns that can be obtained from money invested in any way. Real research is expensive. Care must be taken that there is no duplication.

In any event, the most economical plan will be for the AMERICAN CERAMIC SOCIETY'S general offices to take care of all of the organization work. The general meetings would be one and the same. The Ceramic Institute itself should be very closely connected with our SOCIETY, but each of the component Institutes should be separate from the SOCIETY and self-determining.

Each of us, and especially those in charge of the divisional work, should give this matter their most careful thought, and at the Columbus meeting, definite plans should be made to initiate the organization of each of the separate Institutes. We have the opportunity here to initiate a co-operative plan such as has never been dreamed of in any field, and one which will bring actual results to the silicate industry. I hope that each one who reads this and is interested, will give this matter immediate and careful consideration and try to formulate some definite plan, so that when we get together in Columbus, we can make a real start. This plan must be built on a secure foundation, and we need the best from every worker in our SOCIETY.

NEW MEMBERS RECEIVED AUGUST 15 TO SEPTEMBER 15

PERSONAL

Butler, E. L., 111 W. Washington St., Chicago, Ill., Owner and Manager, E. L. Butler Clay Co.

Farr, Harry V., 2 Miller Place, Ferguson, Mo., Consulting Engineer, Maphite Company of America.

Gasteiger, W. H., Braemar, Carter Co., Tenn., Engineer, Rex Company.

Innes, David H., 905 S. Wright St., Champaign, Ill. Student.

Kriege, Herbert F., 1354 Forsythe Ave., Columbus, Ohio. National Agstone Fellow, Soils Dept., O. S. U.

von Krogh, Johan C. W., Geologisk Museum, Kristiania, Norway. Engineer, Norwegian Government.

Purky, Jos. F., Paducah, Ky., Manager, The Paducah Clay Co.

Sargent, Malcolm C., 163 Norfolk St., Wollaston, Mass. New England Sales Manager, General Refractories Co.

Vane, Bernard, Supt., Hopewell China Corp., Hopewell, Va.

Membership Workers' Record

	Personal
R. F. Geller	1
Joseph A. Martz	1
Cullen W. Parmelee	1
C. A. Underwood	1
H. E. Weightman	1
W. W. Wilkins	1
Office	3
Total	9

PROGRAM FOR SOCIETY SUMMER MEETING, LOS ANGELES, CALIFORNIA, OCTOBER 6 and 7, 1924

Morning Session

Opening Address.....Ross C. Purdy
Tableware on the Pacific Coast.....W. G. Jackson
Artificial Sillimanite as a Refractory.....Hewitt Wilson
Synthetic Sillimanite in Ceramic Bodies.....T. S. Curtis
Overhead Transportation in a Clay Plant by Engineering Department of the Los Angeles Pressed Brick Company.....Ross D. Plank

Afternoon Session

Cast Iron Enamels (with microphotographs).....A. Malinovsky
Sagger Rules for Control of Glazes.....Ross C. Purdy
Notes on Terra Cotta Body Shrinkage.....P. G. Larkin and E. R. Curry
Notes on Development of Vitreous Slips for Terra Cotta.....H. E. Davis and J. S. Lathrop
Tunnel Kilns.....E. W. Ekstrand
Construction of Kiln Crowns.....John Sawyer

THE PITTSBURGH SECTION HONORS ENGLISH GUESTS

Dr. J. W. Mellor and Dr. and Mrs. W. E. S. Turner were honored with a dinner at the University Club, Pittsburgh, Pa., given by the Pittsburgh Section, American Ceramic Society on Thursday evening, Sept. 4, 1924. Eighty-eight members and guests were present.

J. W. Cruikshank, of the Cruikshank Engineering Company and Chairman of the Section, proposed the drinking of toasts, first to the King of England, complimentary to the distinguished English scientists and next to the President of the United States. Mr. Cruikshank expressed the appreciation of the members of the Pittsburgh Section in having the honored guests with them. He also recalled his acquaintance with Dr. Turner in 1918 at which time he was in England, and visited Dr. Turner at the University of Sheffield.

The toastmaster for the evening was Dr. Alexander Silverman, head of the Chemistry department of the University of Pittsburgh. Dr. Silverman emphasized the importance of the glass industry to humanity; what it means to have windows, both plain and stained to keep out undesirable elements and yet admit light and warmth; the value of glass as an artistic decoration for our homes and finally the vital importance of binoculars for our mariners; telescope lenses, etc.

Dr. W. E. S. Turner of the University of Sheffield and past president of the Society of Glass Technology of England expressed his appreciation for the hospitality that had been extended to him on the present visit to this country and also on two previous trips. On behalf of the British Society he extended a cordial invitation to the members of the American Ceramic Society to visit England in the near future. Remarks were also made pertinent to the comparison of the two countries, England and America. England, he stated, has not recovered from the depression of 1920 to the same extent as America. Dr. Turner referred to the wonderful achievements that are the direct outcome of research and urged upon the Society the importance of this country to establish a center for the advancement of glass technology.

He discussed the results of his experiments with wet and dry glass batches on which eight tests were made on the same materials. The molten metal was worked by the same man who knew nothing of that particular batch with results showing that while the ingredients of the batches were the same, the glassware made from the wet batch was entirely different from that produced from the dry materials.

Dean Manning of the University of Pittsburgh discussed our recent national conventions of the Republican and Democratic parties.

Chancellor Bowman, also of the University of Pittsburgh, questioned the efforts of the scientists of this country to relieve the restlessness existing among laborers in industry. He emphasized the fact that one hundred

years ago the population of this country was occupied chiefly with securing household comforts and necessities and stated that present-day problems should be subjected to scientific study as much as chemical problems. He mentioned the services which have been rendered to various industries by the Mellon Institute, and noted the excellent facilities afforded by Pittsburgh to train efficient workers and for straight thinking.

Dr. J. W. Mellor, eminent chemist and ceramist of Stoke-on-Trent, also gave an entertaining address. Dr. Mellor has been attending the recent convention of the British Association for the Advancement of Science in Toronto. He has made highly valuable contributions to the ceramic field and has written many books on chemical subjects. He is also an authority on higher mathematics.

Ross C. Purdy, Secretary of the American Ceramic Society, was introduced and made a brief talk.

Those in attendance at the meeting were:

E. W. Tillotson
Mrs. Tillotson
A. V. Bleininger
Chancellor Bowman, U. of Pgh.
W. E. S. Turner
Mrs. Turner
J. W. Cruikshank
Dean Manley
J. W. Mellor
H. L. Dixon
Mrs. Dixon
Louis Reizenstein
Ross Purdy
Alexander Silverman
Cyrus G. Dunkle
John F. Byrne
Sandford S. Cole
Mrs. Cole
R. F. Ferguson
R. A. Robinson
J. E. Hansen
B. M. Larsen
Chas. R. Fettke
Chas. Watkins
C. E. Greider
Chas. L. Jones
Gordon R. Pole
G. E. Meiter
L. O. Peterson
H. J. White
Mrs. White
C. R. McCann
Mrs. McCann
Donald W. Ross
G. W. Cooper
John M. Hammer
George S. Cooper
F. C. Flint
A. H. Wright
Horace Foster, Jr.
Miss McKillop
M. G. Babcock
A. W. Kimes
Mrs. Kimes
R. E. Kimball
Mrs. Kimball
Wm. J. Miller
V. G. Greene
F. A. Rotandaro
Joseph Heidenkamp
Miss Heidenkamp
Joseph Heidenkamp, Jr.
Mrs. Heidenkamp, Jr.
W. A. Turner
Thos. MacConnell, Jr.
J. O. Handy
Harry S. Hower
Mrs. Hower
H. H. Blau
C. A. Stimpson
W. E. Daugherty
H. R. Urbach
W. F. Wenning
H. V. Huber
J. B. Luckie
Glenn D. Williams

Fig. 1.—Pittsburgh Section, American Ceramic Society, Sept. 4, 1924.

Harry Willetts
Mrs. Willetts
D. W. Loomis
F. M. Ritchie
Mrs. Ritchie
T. F. Harnock
Mrs. Harnock
H. G. Dixon
Mrs. Dixon
C. H. Walker
R. J. Weithorn
H. S. Robertson
E. P. Arthur
Mr. Stewart
J. M. Manor
T. A. Shegog
H. A. Thrum
C. L. Shegog

PITTSBURGH SECTION HEARS BRITISH CHEMIST

The Pittsburgh Section of the American Ceramic Society met with the Pittsburgh Section of the American Chemical Society on Friday, September 19 at the Pittsburgh Experiment Station, Bureau of Mines, where they heard an address by Sir Robert Robertson, Chemist to the British Government. Sir Robert, who is an authority on the chemistry and technology of explosives talked on "Ammonium Nitrate and Some of Its Properties and Applications."

L. E. BARRINGER AT CENTENNIAL CELEBRATION

President Landrum has appointed L. E. Barringer of the General Electric Company, Schenectady, N. Y., to act as representative for the Society at the Celebration of the 100th Anniversary of the Founding of Rensselaer Polytechnic Institute to be held at Troy, N. Y., October 3 and 4.

DR. LANGENBECK REPRESENTATIVE AT MEETING

Karl Langenbeck, U. S. Tariff Commission, Washington, D. C., was appointed representative of the American Ceramic Society by President R. D. Landrum to attend the Centenary Celebration of the Founding of the Franklin Institute and the Inauguration Exercises of the Bartol Research Foundation. This meeting was held in Philadelphia, September 17, 18 and 19, 1924.

G. A. BOLE ADDRESSES NORTHWEST STATION

G. A. Bole, superintendent of the Ceramic Experiment Station, U. S. Bureau of Mines, Columbus, Ohio, has returned from an extended trip to the Pacific Coast where he made a survey of clay plants and visited the Bureau Stations at Seattle, Wash., and Berkeley, Calif. While in Seattle Mr. Bole was guest at a luncheon given by the members of the Pacific-Northwest Section. The work of the U. S. Bureau of Mines was presented by Mr. Bole in an interesting address at this meeting.

He also visited the Station located at Rollo, Mo., where research work in zinc refractories is being conducted.

FELDSPAR INVESTIGATION[1]

On page 357, *Bulletin* Section, September number of the *Journal*, a typographical oversight made the entire note read as though it were by Dr. Burgess, director of the Bureau of Standards. The first four paragraphs of that note were not a part of Dr. Burgess' communication.

NOTES AND NEWS

THE EDWARD HART CELEBRATION

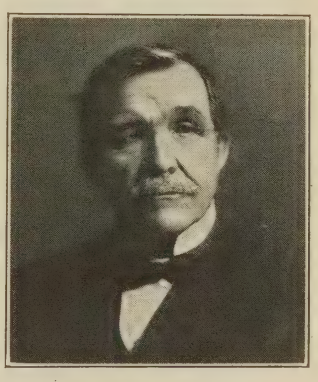
The American Ceramic Society joins with Dr. Hart's many other friends in real appreciation of the friendly man, the interesting writer, the practical scientist and the business man and associate, Edward Hart.

Dr. Hart has been an active member of this Society for several years. When possible he attended our meetings and participated in the discussions. He undertook on his own responsibility the printing for the Society the "Collected Writings of Herman Seger." Dr. Hart has made substantial contributions to ceramic technology, the benefits of which will be shared by ceramists in future generations.

To Eugene C. Bingham we are indebted for the following notes:

In 1874 there came to Lafayette College as professor of analytical chemistry, Thomas M. Drown, later president of Lehigh University. With him there came as his assistant a young Quaker from Doylestown, Pa., by the name of Edward Hart.

Not satisfied with his knowledge of organic chemistry, in 1876 he applied for a fellowship at the newly started Johns Hopkins University. Dr. Remsen must have scanned young Hart more carefully than he did his college diploma, for the latter was nonexistent. Edward Hart was given the fellowship and he kept it for two years and received his doctorate into the bargain.



Dr. Edward Hart

Dr. Drown resigned in 1881 and Dr. Hart was then made assistant professor in charge of the department.

Dr. Hart had already started a series of business enterprises. In 1881, with John T. Baker, a Lafayette graduate of 1878, he began to make refined chemicals. They were without experience and with only $500 capital, but they possessed plenty of courage. Renting land at $10 per year, they put up rough buildings, erected furnaces, and started in to manufacture pure hydrochloric acid, nitric acid, sulfuric acid, and ammonium hydroxide. After two years their capital proved too small and they took in George P. Adamson, of the class of 1884, and moved the plant to a five-acre plot near the railroad. The use of crude nitric acid in considerable quantities suggested the manufacture of the acid directly from sodium nitrate, and this led to the invention of the Hart boiler and condenser, which are still widely used. Thus, with Dr. Hart as silent partner, the firm of Baker & Adamson was started, which was later merged into the General Chemical Company, and which in turn has merged into the Allied Chemical & Dye Corporation.

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[1] Correction.

When he began to edit the *Journal of Analytical and Applied Chemistry* he found trouble in getting the *Journal* out on time, so he audaciously decided to be his own printer and in 1887 he engaged a student as the foreman of the proposed company. In 1893 Harvey W. Wiley, who had recently become president of the American Chemical Society, requested Dr. Hart to become the editor of the *Journal.* There thus started an intimate friendship which has increased with the passing years. Taking up the editorship, Dr. Hart found but two articles ahead while there were six numbers in arrears. He unselfishly gave up his *Journal of Analytical and Applied Chemistry* and merged it with the Society's *Journal.* Dr. Wiley busied himself in getting papers, while Dr. Hart edited and printed them. In 1894 he published the first volume of Dr. Wiley's "Principles and Practice of Agricultural Analysis," and a year later Dr. Remsen asked him to print the *American Chemical Journal.*

The growth of the chemistry department of the college under Dr. Hart was continuous. In 1918 friends of Dr. Hart raised $10,000 to endow the Edward Hart Research Fellowship, as a tribute to his great service in building up chemistry in America. Although Dr. Hart retired from the direction of the chemistry department in 1916, he has retained the title of professor of chemical engineering and he has completed a round fifty years of service as a teacher.

Dr. Hart possesses great originality together with boundless energy; but modesty in regard to his own attainments and kindliness are even more characteristic of his later years. Still working on important industrial problems, such as the recovery of potash from greensand, much of his time is given to civic work and to the improvement of the farm which he has recently developed.

Dr. Hart was for two years a member of the Common Council of Easton and a member of the Highway Committee. He has been chairman of the Easton City Planning Commission since 1906. He has been three times president of the Northampton County Historical Society. He has been president of the Easton Motor Association, trustee of the Easton Board of Trade, and in 1912 he was candidate for Congress on the Progressive ticket. Although a practical printer, he advocates the use of the metric system in printing.

Along with his other work Dr. Hart has written several textbooks and considerable verse of a humorous or sentimental character. His description of "The Hobo" is certainly not autobiographical:

I think some evil molecules
  Must in my system lurk
I really am not lazy
  I just don't like to work.

Program of the Edward Hart Celebration and Intersectional Meeting

Under the auspices of the Lehigh Valley Section, the New York Section, the Philadelphia Section, the Wilmington Section, and the South Jersey Section of the American Chemical Society.

October 16, 17 and 18th

Thursday—

9:00 A.M. Gayley Chemical and Metallurgical Laboratory, Registration
10:30 A.M. Colton Memorial Chapel, Founders' Day Exercises, One-Hundredth Anniversary of the Founding of Lafayette College

2:30 P.M. Pardee Auditorium. General Theme: "Fifty Years of Chemistry in America." Speakers: Dr. Edgar F. Smith, Dr. Harvey W. Wiley, Dr. William H. Nichols, and Dr. Bradley Stoughton

5:00 P.M. Reception and Tea. Residence of Dr. and Mrs. Edward Hart, College Campus

7:00 P.M. Banquet at Northampton Country Club, in honor of Dr. Hart. Ladies are invited

Friday—

9:30 A.M. Pardee Auditorium, Plasticity Symposium.

2:00 P.M. Plasticity Symposium (Continued)

Saturday—

9:00 A.M. Excursions to points of interest in the Lehigh Valley:—

1. Martin's Creek, Bangor and Delaware Water Gap.
2. Easton and Phillipsburg plants.
3. Lehigh University and the Bethlehem Steel Co.
4. The New Jersey Zinc Co. Research Laboratory and Plant.

M. E. HOLMES AT COLUMBUS STATION

Major E. Holmes, recently has joined the staff of the ceramic station, U. S. Bureau of Mines, at Columbus, Ohio. Dr. Holmes will have charge of the work which the Bureau is doing in coöperation with the Dolomite Products Company of Cleveland, Ohio. Dr. Holmes brings to this work a wide experience gained in the lime and gypsum fields.

BUREAU OF MINES NOTES

Zinc Refractory Research

The Bureau of Mines is starting a survey of the conditions under which zinc refractories must give service. The field work is being carried out simultaneously with a survey of the fuel economy problem. Messrs. Brewer and Rice are in the field surveying the conditions which obtain at retorting plants in the tri-state and St. Louis districts.

Mr. Keuchler at the Rolla Station is carrying on fundamental research into properties (*a*) of zinc retorts now in use, (*b*) raw materials used in their manufacture. The purpose of the investigation is to develop a better refractory for the service or to so modify the process as to lengthen the life of the refractory now in use.

Power Plant Refractories Survey

A coöperative agreement has been made between the Department of the Interior and C. A. Hirshfield of Detroit, representing a group of large central power plant operators, to make a survey of present conditions relating to the use of power plant refractories. The survey will be conducted by engineers of the Bureau of Mines.

With the present high ratings at which boiler plants are being operated and the increasing use of pulverized coal with its attending high temperatures, the refractories now available for lining boiler furnaces are proving inadequate. In this survey a study

is being made of the characteristics of refractories now available for use in power-plant boiler furnaces, and the conditions under which they are used, their life in operating practice under the conditions prevailing at different plants and the way in which the refractories now marketed fail to meet these conditions. The purpose of the survey is to obtain fundamental data to be used in bettering refractory service.

DEPARTMENT OF COMMERCE NOTES

Ceramic Whiting Specification

July 25, 1924

The desirable qualities of ceramic whiting, used in the manufacture of glazes, enamels, and other ceramic products, are given in a specification for this material recently issued by the Bureau of Standards. It is recommended that the material should contain not less than 97% of calcium carbonate and should be very fine, so that 98% of it will pass a No. 200 screen.

This is the 5th of a series of specifications issued by the Bureau for the kinds of lime required by different chemical industries. The preceding 4 dealt respectively with lime for use in cooking rags, in causticizing, and in the manufacture of sulphite pulp and of glass. They were prepared under the direction of the Interdepartmental Conference on Chemical Lime, composed of representatives of the Bureau of Standards, the Geological Survey, the Bureau of Mines, the Department of Agriculture, and the Chemical Warfare Service.

The specification is given in Circular No. 152 of the Bureau of Standards entitled "Recommended Specification for Ceramic Whiting." Copies can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 5 cents, cash.

Make Sweeping Reduction in Restaurant and Cafeteria Chinaware

Reduction of varieties and sizes of restaurant and cafeteria chinaware from 66 items to 176 will become effective before the first of next year, as a result of action taken by the Board of Directors of the National Restaurant Association at the association's convention in Chicago recently, according to a report to Ray M. Hudson, chief of the Division of Simplified Practice, by H. Ross Colwell of the Division, who has been working on the simplification of these items. There were 16 more items on the list retained by the retaurant and cafeteria interests than on the list of the hotel industry after the latter had simplified its variety.

The 492 eliminations recommended by a joint meeting of committees of manufacturers, distributors and users will take effect about the first of the year; though Mr. Colwell reported that certain potteries manufacturers are issuing "standard" lists with marked inducements in prices for such lists.

Three committees have been appointed, representing the manufacturers, distributors and consumers and their allied interests. These will meet on September 3 at a morning session, in conference with H. Ross Colwell of the Division of Simplified Practice, who will be speaker at the afternoon meeting of the convention.

The manufacturers' committee comprises C. W. Read of the Shenango Pottery Company of New Castle, Pa.; E. L. Tolbert of the Onondaga Pottery Company of Syracuse, N. Y., and D. W. Scammell of the Scammell China Company of Trenton, N. J. The membership of the committee representing the distributors includes Arthur Nason

Howe of Mitchell Woodbury Company, Boston, Mass.; L. Barth & Son of New York City; Albert Pick & Co., Chicago; The Straus Company of Richmond, Va.; and the Dohrmann Commercial Company of San Francisco, Calif. Representing the consumer interests is a committee comprising Harry S. Baldwin of Springfield, Mass.; Nate W. Stone of the Hippodrome Inn., Cleveland, O.; Frank Knapp of McCreary & Co., Pittsburgh, Pa.; Allan Pollok, president of the American Association of Dining Car Superintendents, San Francisco, Calif.; Horace Boos of Boos Brothers Cafeteria Co., Los Angeles, Calif.; W. I. Hamilton, director of research of the American Hotel Association, Chicago, Ill.; and a representative of the American Telegraph and Telephone Co., New York City. A. B. Carder of Los Angeles, Calif., is secretary of the Association.

These committees, following separate meetings, will hold a joint session, at which will be determined the recommendations to be reported to the convention.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Summer Meeting)	Oct. 6–7, 1924	Los Angeles, Calif. Hotel Biltmore
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Assn. Adv. of Science	Dec. 29, 1924–Jan. 3, 1925	Washington, D. C.
Am. Assn. of Flint and Lime Glass Mfrs. (Quarterly Meeting)	Oct., 1924	Pittsburgh, Pa.
Am. Assn. of Flint and Lime Glass Mfrs. (Annual Meeting)	July, 1925	Atlantic City, N. J.
Am. Concrete Institute	Feb. 24–27, 1925	Chicago, Ill.
Am. Electrochemical Society	Oct. 2–4, 1924	Detroit, Mich.
Am. Engineering Council (Administrative Board)	Oct. 17–18, 1924	Chicago, Ill.
Am. Face Brick Assn.	Dec. 2–4, 1924	Hot Springs, Va.
Am. Foundrymen's Assn.	Oct. 11–16, 1924	Milwaukee, Wis.
Am. Gas Assn.	Oct. 13–17, 1924	Atlantic City, N. J.
The American Institute	Dec., 1924	New York City
Am. Inst. of Chemical Engrs.	Dec. 3–6, 1924	Pittsburgh, Pa.
Am. Inst. of Min. & Met. Engrs.	Oct. 13–15, 1924	Birmingham, Ala.
Am. Mining Congress	Sept. 29–Oct. 4, 1924	Sacramento, Calif.
Am. Society of Mech. Engrs.	Dec. 1–4, 1924	New York City
Common Brick Mfrs. Assn.	Feb. 9–13, 1925	Chicago, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Edward Hart Celebration and Intersectional Meeting	Oct. 16, 17, 18, 1924	Easton, Pa.
Exposition of Inventions	Dec. 8–13, 1924	New York City
Hollow Bldg. Tile Assn.	Jan., 1925	Chicago, Ill.
Management Week (Auspices of Am. Soc. of Mech. Engrs.)	Oct. 20–25, 1924	New York City
Manufacturing Chemists' Assn.	June, 1925	New York City
Mining & Met. Society of America	Jan. 13, 1925	New York City
Natl. Academy of Sciences	Nov. 10–12, 1924	Cambridge, Mass.

Organization	Date	Place
Natl. Assn. of Mfrs.	May, 1925	New York City
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	March, 1925	Pittsburgh, Pa.
Natl. Assn. of Stove Mfrs.	May 13–14, 1925	New York City
Natl. Clay Products Industries Assn.	April, 1925	Chicago, Ill.
Natl. Exposition of Power & Mech. Engr.	Dec. 1–6, 1924	New York City
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
Natl. Lime Assn.	May, 1925 (?)	
Natl. Safety Council	Sept. 29–Oct. 3, 1924	Louisville, Ky.
N. J. Clayworkers' Assn. and E. Sect. of the American Ceramic Society	Dec., 1924	New Brunswick, N. J.
Optical Society of America	Oct. 23–25, 1924	Boston, Mass.
Refractories Mfrs. Assn.	Oct. 3, 1924	Pittsburgh, Pa.
Society of Chemical Industry	Oct. 17, 1924	New York City
Society of Glass Technology	Oct. 15, 1924	Sheffield, Eng.
Taylor Society	Dec. 4–6, 1924	New York City
Tenth Exposition of Chem. Industries	Sept. 28–Oct. 3, 1925	New York City
Tile & Mantel Contractors' Assn. of America	Feb. 9, 1925	Louisville, Ky.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)
Western Paving Brick Mfrs. Assn.	Jan., 1925	Kansas City, Mo.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Mary G. Sheerer, H. S. Kirk — Art
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G. E. Barton, A. N. Finn — Glass
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Vol. 3 November, 1924 No. 11

EDITORIAL

YOUTH MAY SERVE

Seymour Parker Gilbert, Jr., the thirty-two year old fiscal genius, was recently appointed Agent-General for Reparations. Alexander Hamilton retired as Secretary of the Treasury at the age of thirty-eight. Two remarkable men, these, and not at all representative of the average. These and the many other well-known young men of large affairs who have won recognition not by wealth, family or fate but by might of personality, mental resourcefulness and hard work prove that age is not the determining factor in professional preferment. Youth need not hesitate. Youth may obtain a commanding position by qualifying as one capable of rendering service.

Gilbert has been made Agent-General for Reparations because he can deal with men straight and convincingly; because he can see and evaluate clearly both the causes and their effects; because he knows how and where to obtain information and also (and this is the point we wish to emphasize) because he worked many unscheduled hours alone.

Eight hours a day has not been Gilbert's schedule for work nor has it been for any other successful young man. No man has earned recognition and a place in affairs by mere possession of talents. Success is attained by continuous systematic work.

Many of our college graduates devote too little time outside of their

scheduled factory hours in a searching study of the science in which they wish to gain recognition as experts. To too many the "burning of midnight oil" for self-advancement in their chosen profession is not a habit nor a practice.

Social intercourse and an interest in community affairs is excellent mental recreation and a means of developing personality and ability to deal with men broadly but to devote eight of every twenty-four hours to such activities is not leaving enough time for self-advancement in one's chosen profession.

Eight of each of the twenty-four hours belong to the employer. To whom do the other sixteen belong? Our physical being requires eight of these for rest and refreshment. What portion of the other eight shall be used for self-betterment in the profession in which a livelihood is to be earned?

The college graduate has a greater need and should feel a larger urge to "burn midnight oil" in study than any other industrial worker for in no other wise can he qualify for a foremost professional ranking, and in no other wise can he meet the expectation of either his employer and industrial associates or of himself and family.

Young men will have large industrial opportunities and responsibilities if they qualify and no young man can qualify except by proper use of the eight hours which are his each day. Industrial preferment and the remuneration and pleasure which follow can be secured in no other wise.

The prime purpose of the American Ceramic Society is to encourage and to plan for the most profitable use of that third of each one's time which is his in which to make himself better qualified as a ceramic worker. This opportunity rapidly decreases as age advances. It belongs to youth.

PAPERS AND DISCUSSIONS

COMPARATIVE SERVICE TESTS OF GROSS ALMERODE AND DOMESTIC CLAY POTS[1]

By Warren S. Williams

ABSTRACT

Glass-drawing pots made from Gross Almerode clay proved to be superior in a service test to pots made from a synthetic siliceous domestic clay mixture. When removed from service the faces of the Gross Almerode pots are pitted. The faces of domestic clay pots are surface cracked. The blistering of the glass caused by this cracking is eliminated by substituting silica brick grog for fire clay grog.

Introduction

Clay from the Gross Almerode mines of Germany has been used by glass refractories manufacturers for years. In fact, before the war, many manufacturers in America used this imported clay exclusively. During the war, they were forced to substitute domestic clays and some manufacturers have returned again to its use after the war. The characteristics and working qualities of this clay are of considerable interest to the industry because of its wide application in glass refractories manufacture.

Gross Almerode clay is now received in casks weighing approximately 1000 pounds. It is light gray in color and has been washed and is received in nut size lumps. These break up easily in a dry pan into a very fine dust. When mixed with water it is sticky, but not tough nor very plastic to the feel of the hand. This sticky quality gives the clay a ready bond without much danger from laminations while molding it into pots.

For pot making, the clay is mixed with 60% of grog which permits the pots to be dried rapidly and safely. Drying conditions must, indeed, be very severe to disrupt the bond of this open porous clay. In the dried state, the pot batch, using 40% raw clay and 60% of grog, is comparatively weak. The dry modulus of rupture of this mixture is given in Table I.

Table I

	Modulus of Rupture Dry	Modulus of Rupture Burned
German Mix	134	654
Synthetic Mix	223	825

Screen Analysis of Grog Used in German Mix

	Mesh	Per cent
Retained on	10	21
Retained on	20	26
Retained on	40	24
Retained on	60	12
Retained on	80	2
Through	80	15

[1] Presented at the Atlantic City Meeting, February, 1924 (Glass Division).

It is sufficiently strong to permit lifting the pots shown in this *Journal*[1] by the lugs. When burnt to cone 3, the pots are a light buff color and are strong enough to bear their own weight, plus the weight of the glass, when suspended by their lugs.

The test bars for the burnt modulus given in Table I were burned in the same pot arches as the pots themselves, taking about seven days to reach cone 3. Both dry and burnt modulus are the average of over 150 bars made at differing times and burnt in several different pot arches. The screen analysis of the grog used in these test bars is also presented.

The chemical analysis and physical properties of the German clay now being received correspond closely with that given by Bleininger.[2]

Various attempts have been made to duplicate the service obtained from glass-drawing pots made of German clay by substituting synthetic domestic clay mixtures. One of these mixtures was obtained from a large glass refractories manufacturer, pugged, aged and ready to use. Judging by appearance, the grog size was apparently the same as that used in the German clay batches with which they were compared. The transverse strength, as given in Table I, is stronger than the Gross Almerode and the synthetic mixture, also, proved to be superior in the quenching test. The porosity-volume shrinkage curve closely approximates the foreign clay. The residue left on a 100-mesh screen after washing, plainly shows the addition of fine sand to increase the silica content.

The method employed in comparing pots made from the synthetic mix with the German clay pots was to set them in the same pot arch at the same time. Nine pots are set in an arch, four of which were synthetic, sandwiched alternately between five German. By this setting, the pots were burned to the same temperature, used at the same tank during the same period, and under like conditions. A fair comparison is thus obtained. Eleven pot arches were set in this manner with the following results:

48—Pots of synthetic clay served 607 days; average 12.6 days.
54—Pots of German clay served 1058 days; average 19.6 days.

Chemical analyses of both clay mixes burned, follow:

	Burnt German	Burnt synthetic
Silica	77.48	72.34
Alumina	18.00	22.40
Titanic acid	2.48	1.56
Iron	.88	2.00
Lime and magnesia	.55	.52
Alkalies	.52	1.14

[1] W. S. Williams, *Jour. Amer. Ceram. Soc.*, **6** [11], 1148 (1923).

[2] Bur. Stand., *Tech. Paper* **144.**

The free silica in the German clay has been identified by an experienced petrographer to be very fine grained quartz. This quartz requires elutriation to separate it from the clay substance.

The characteristic difference in the appearance of the German pots and those made of various domestic clays, after they are removed from service, is the absence of "turtle-back" cracking in the bottom of the German clay pots. This is apparently due to the more soluble nature of the foreign clay. The glass seemingly dissolves the surface of the pot at approximately the same rate at which the fine cracks are formed. The outside surface of the pot, not in contact with the glass, exhibits the "turtle-back" cracking in like manner to the domestic pots.

After a week's service, the German pots exhibit a uniformly pitted surface like small-pox marks. If the slope from the tops to the bottoms of the pits is gradual, the pits do not affect the cylinder of glass. If the slope is abrupt, air is entrapped in the pit while draining the pot. The expansion of this air, when glass is again ladled into the pot, forms blisters or seeds in the glass. This blistering effect in the domestic clay pots, due to entrapped air in the "turtle-back" cracks, was the cause of removing from service over 90% of all domestic clay pots.

GLENDALE, CALIF.

Discussion

W. S. WILLIAMS: Actual service tests over a long period of years have demonstrated the superiority of the refractories made by the Pittsburgh Plate Glass Company in many branches of the glass industry. Its application in the service herein described is restricted to only one service in one branch of the industry. The fact that it failed herein seems to prove its superiority over the German clay, for other glass refractories prevent blistering from the "turtle-back" cracks. This resistance to corrosion without stones would be strongly in favor of the synthetic batch in other applications such as tank block, plate glass and flint glass pots, rings, boots, floaters, etc.

C. E. FULTON: I believe the pots referred to by Mr. Williams are the reversible pots used in the American Window Glass cylinder process. It is possible that the so-called synthetic mixture is used in making pots for melting plate glass. If so, it is a combination of domestic clays which for plate glass purposes gives better results than German clay batches. However, the grinding is considerably finer than that given in the paper for the German clay pots. In fact with the domestic batch there would be practically no residue on the 10-mesh screen so that the difference in results would not be due entirely to the use of German clay.

Mr. PAYNE: In other words you would not say that the domestic pots were better than the others?

C. E. Fulton: He shows that the German clay pots gave better results in this particular test, but the point which I want to bring out is that the comparison is unfair to the domestic clays in that the chief defect of the domestic pots was cracking which in a large part could be attributed to the fineness of grinding.

Mr. Payne: Of course, during the war we used very little German clay and I guess this was the case with the paint manufacturers. After the war some used it and some did not; some advertised that they were again using German clay and some advertised that they did not and would not again use it. Are there any tank block manufacturers here who would care to say that they are using the German clay?

Mr. Aurien: I recall that our company probably 18 or 20 years ago imported German pot clay. Why it was ever discontinued I do not know but I do know that in the past 16 or 18 years we have not used any German pot clay. I know it was the contention at one time that one had to have German pot clay to make a block good, but I guess this theory has been disproved.

Mr. Brownlee: We are now using German pot clay.

Mr. Montgomery: We do not use any German pot clay in the pot used in the manufacture of optical glass.

Mr. Dixon: A number of years ago I was in the pot business and we had quite an experience with these various clays. We were in the business when Missouri clay was first discovered and brought into use for making pots. In those days we had to depend entirely upon German or English Stonebridge clays. The pots made of that clay answered the purpose admirably during the time of the use of such crude furnaces. The furnaces then were most all of the same character as bucket furnaces, not hot running gas furnaces such as we employ today.

I remember very well at that time we had a standing order from the Corning Glass Co. for 100 pots to be kept on hand all the time and also from the Old Meriden Glass Co. of Meriden, Conn. and from the New Bedford Glass Co. They all made a very rich lead glass. The pots were designed especially for this glass. When the Missouri and other domestic clays came into use we attempted to use them for this purpose but we could not make them stand the erosion from that rich lead glass. The German clay pots would stand it and the domestic clay pots would not without causing stones. The pots had to be made of a special mixture. German clay was used almost exclusively. Now, as time went on they improved the furnaces. Instead of making 2 or $2^1/_2$ melts a week they got to making 3 and $3^1/_2$ and 4 and $4^1/_2$, and the pots made of either Stonebridge or German clay would not stand it. They would melt down or bridge out of shape. We had to overcome that result by finding some material that was more refractory to mix with it. The Missouri pot clay met this requirement.

Now the proper mixture of these met the two conditions; it stood the intense heat of the furnace and the pots stood up well, and the mixture of the German clay made them wear better. Invariably if we would leave the German clay out for any reason the pots would not wear as well, and if we would leave out the Missouri clay the pots would not stand up.

Then we came along to the time when we were making a certain grade of lime glass, running intensely hot furnaces, building very large pots that held from 3600 to 4000 pounds to be melted in 24 hours. The pots had to stand severe service. These pots were made entirely of Missouri and other domestic clays; no German pot clay in them.

That was a development of our experience in making pots to meet those various conditions. When tank blocks came into use in this country naturally the block manufacturers followed the same practice. They had to make a block that would stand the erosion of the alkalis used in glass and they had to make a block that would stand the heat. They mixed the two clays together. Some have not done so, and strange to say the success of all of them has been about equal. I could not say today whose blocks are best. We use them all. I do not think anybody else can because the furnaces and operating conditions vary so much.

Mr. Williams: As I remember A. V. Bleininger attempted to find the actual properties of the German clay which made it so desirable and then tried to reproduce those properties with American clay. As I recall the result obtained was quite similar. He blended several American clays rather than using any single clay and not wholly those which are commonly known as fire clays. He used kaolins and ball clays in part substitution for the Missouri and Pennsylvania fire clays. As nearly as we could see the life or tendency to corrode in the pots was improved.

I can speak more positively regarding the optical glass melting. We could not use an ordinary fire clay pot from the standpoint of color alone but from the standpoint of corrosion. We found with the heavy lead and the 30% barium glasses which were exceedingly corrosive that just one melt alone would go through fire clay pots. The pots made with kaolins and ball clays could be reused.

WHAT HAS BEEN THE EXPERIENCE IN SUBSTITUTING DOMESTIC SECONDARY AND PRIMARY KAOLINS FOR ENGLISH CHINA CLAYS?[1]

By Karl Langenbeck

ABSTRACT

The duty of the U. S. Tariff Commission with respect to ascertaining if the rates of import on foreign clays are bringing about freedom of commercial competition in domestic clay.

[1] Presented at Atlantic City Meeting, Feb., 1924 (Whitewares Division).

Two instances, in the manufacture of electrical porcelain, were brought out, in which the consumers buy foreign or domestic china and ball clays, in which competition is free. That is to say, experience with competitive clays is sufficiently complete to enable all purchases to be made on the basis of price, f.o.b. factory.

The factor of uniformity in deliveries, brought out indictment of domestic china clays and English ball clays, as irregular in quality.

The inadequacy of analytical and experimental methods and practices, in failing to give comparable data, as between clays similar in kind, was charged by all producers. No defense to the charge was made by any ceramist present.

The claimants of the electrical porcelain industry, of experience enabling them to substitute competitive clays for each other, gave no information on the character and limits of their tests.

As there was manifest lack of progress in the testing of clays, that would lead to safe subsitution, the failure of free competition between foreign and domestic production does not lie in the economic field. It must be charged to the ceramic profession as a whole.

Introduction

What the Tariff Commission Is

I may mention in instigating inquiry on substituting domestic secondary and primary kaolins for English china clays, that I have been connected with the United States Tariff Commission for the past two years, organizing what was known as Schedule 2, which relates to the non-metallic minerals, cements, pottery and glass, and the raw materials which go into them.

Under the present Tariff Act, which is distinguished from previous ones, you may have heard that it embodies flexible provisions, so called. The idea is that in the hurly-burly of constructing a new Tariff Act, it has been the experience of Congress that they get from the parties that are vitally interested, information on the subject, and often very pertinent information does not reach them from the public at large or from those concerns that are not strong enough to send representatives to Congress. In the vast amount of business which a Congress always has to enact, there is scarcely time to thresh out questions thoroughly. And then statistics and information which are brought to Congress, while undoubtedly honestly given, naturally have a human bias.

Therefore, Congress, in passing the present Tariff Act, envisaged this provision entirely aside from party considerations.

We know, of course, in a general way that the strength of the Democratic Party lay in its traditions from the old division of the country, and that the South, where the strength of the Democratic Party has continued, was in the early days, interested in producing raw materials. The Republican Party in the North was interested in developing its economic system which was to endeavor to make the country self-contained and bring up manufacturers so that there would be employment for all types of labor and for all aptitudes and interests of the human mind.

Now the country has become more homogeneous. Manufacturers are increasing by leaps and bounds in the stronghold of the Democratic Party, and I think it is the general feeling of the two parties that if they can, in fact, if not in theory, come together on one idea, it is this. The conditions of American living are such that we have higher standards than they are accustomed to in Europe. We have better working conditions and better hours, and no matter how anxious the management of a factory may be to make both ends meet—and its constant problem is the high cost of labor—yet there is the feeling with the manufacturer who is hard pinched, that we do not want to lower the standard of living for all classes in the country because the workmen of the country are large buyers and these things interact, and if we reduce the prosperity of the workman, we reduce his buying power.

Both parties, therefore, are really agreed that the standard of living of the country must be maintained. That being the case, the expedient of a protective tariff, is favored by all parties.

However, the question arises—as there always are qualitative considerations and quantitative ones—"How much?" And Congress has therefore said, "We may not have fixed in the last Tariff Act the right duties. We have not had the facts before us. We may have exercised poor judgment. We may have been carried off our feet by plausible gentlemen who have known how to work us for high protective duty. We want to know."

We, therefore, give the President the power to alter these rates of duty to the extent of 50%, either up or down, on the application of any citizen of the country, whether he be a consumer, a producer or an importer. It is immaterial. They are all citizens of the United States and they are entitled to question. It is then the duty of the Tariff Commission to find out what is the actual cost of production and whether the tariff rates equalize these costs of production, and make their recommendations in accordance with that to the President. The President is then empowered to raise or lower the rates.

You can understand from that that the Tariff Commission has large responsibilities, and it also has mandatory powers to ask the most searching questions of the individual manufacturers.

The idea is not to get the cost of production of an extremely well-organized factory which is financially strong and which can get the best conditions of equipment and labor and that sort of thing, and base the costs of production upon such data of a few outstanding factories. But it is to protect, in industry, the man who is less strong, who has struggled along for years, who has had hard work in meeting his payroll, who cannot take advantage of modern appliances and technical help. He is also an American producer and he is entitled to consideration.

Therefore, we have to get these costs of production as widely as possible from individuals because that is the only place to get them. What we ask is very searching and we give the manufacturers individually the assurance that whatever they send us is absolutely inviolate. We also give the same assurance to the importer in order to get the costs of production by the foreign producer.

If the results justify a revision of the Tariff, only the average is used. In other words, what we have to find out are the costs of production in the industry, not of the individual. The average of the industry can, of course, only be obtained from the information of the individuals. Nothing is given to the public. The public is not even informed whether any inquiry is made until the Tariff Commission decides that the question is subject to inquiry, and after an application has been made to inquire into the subject. Then, in many cases, it is turned down as being inadequate.

But if there is cause, and anything is published it is only this average representing the industry which is published. Even then nothing is done arbitrarily, because public notice is given that there will be a public hearing. There may be economic questions enter into the question that we experts have not been able to ferret out or get the true light on. We have a court room and thirty days' notice is given, and both sides, the foreign producer and his representative, or the importer and producer in this country, can meet face to face and thresh the matter out before the six Tariff Commissioners who sit in the tribunal as the judges.

I think it important that you should know what this coördinate branch of the government is and what its purposes are. If inquiries about any of your commodities should come to your firm, your office may not know what it is for, and you should have direct information by word of mouth as to what the duties of the Tariff Commission are. You can have all confidence that whatever is asked will be for purposes of the Commission only, and will be held inviolate.

It is our business to get just as much information as we can on all of the commodities in our schedule. We send out to get information even if there is no question at all from any party about the particular commodity.

Inquiries on Ceramic Materials

We have had to make inquiries about cement, about common brick, about china clays and ball clays, about the various kinds of manufactures of clay wares and the various manufactures of glass, going even to fine microscopes and telescopes, because they are also in the schedule.

I do not want you to think that I have an encyclopedic mind, but we have to accomplish these things with the aid of our assistants as well as we can.

As something of importance and interest to the Ceramic Division, I sent in a question about china clays. If somebody had questioned it, I would not tell you for I have no right to do so. I am just getting general information, and I thought this would be a great opportunity. The importers of clay would meet here face to face, the producers of our domestic clays would be here, and the technical men who have had experience with one or the other, or both, and you could give candid expression to your views in the face of all interested parties.

You may remember that with the entry of the country into the Great War, the question of keeping open the ocean lanes was a very serious one, indeed. One of the questions that was put to the Bureau of Standards was: Are we going to be able to get English china clay, this product which has become standard for the United States, at least standard as a reference material and a material of use in fine products? Is the production of the country going to be injured during the war period by the cutting off by German submarines or what-not or the demand for more remunerative shipping, from the flow of the English china clay which has come to this country for so many years and in such a large tonnage?

The Bureau of Standards worked on this problem of the use of domestic clays in substitution for the English china clays so that indeed the pottery manufacturer, as well as the paper maker, would have something to turn to.

A. V. Bleininger was particularly engaged in the interests of that work among his other duties, and he reasoned that there are residuary kaolins occurring in our country in the mountainous regions of the Alleghenies which have been exploited to a material extent in western North Carolina. They exist north of there up toward the Potomac, and even further than that, where the mountains have disappeared in Delaware, through spots in Maryland and so on.

There are also the great clay deposits in the coastal region of the South, in South Carolina and in Georgia. These are the secondary kaolins, so called, because while they originated as residuary kaolins first, in the mountainous regions, they were carried down by streams and deposited possibly in lakes and swamps of the seacoasts of an older geological period.

As you know, this moving of a clay by a water body has resulted, through hydrolysis, in making a material that is a white material where it was fortuitously saved from admixture with surface soils in making a material that is more plastic, the plasticity being often astonishingly large, as in the case of those moved as far as the lakes and swamps in northern Florida.

Then Mr. Bleininger envisaged the fact that with the non-plastic residuary clays that we have in the mountain regions, and with the great manipulation that the sedimentary clays received in the Coastal Plain,

we have two products that differ from the English china clays in this, that while the English china clays are residuary clays, they have apparently been subjected to hydrolysis, not to the extent of our southeastern kaolins, but to some extent. So that the English china clays have less plasticity than our secondary clays, and more plasticity than our primary clays. They have retention in paper fiber and so on.

It seemed reasonable, therefore, that the domestic product could be prepared by the use of our two classes of china clays in which the residuary clay plays the part of holding up the body well, so that in the fire it does not sag or shrink, and that it would counteract the excessive shrinkage and the cracking of too plastic clays which might occur with the sole use of the secondary clays. And in that way, the equivalent of the English china clay could be produced.

A good many of the pottery manufacturers were induced to make experiments. Many of those whose conditions are not as strenuous as those who manufacture table ware, introduced domestic clays in this way.

The question that we in the Tariff Commission have to answer is: Why is it that with the duty on English china clay so high our domestic producers are careless in their manufacture? Are the conditions of labor getting to be such that they have to look to a machine shovel proposition and cannot go to refinement, that the English manufacturers do with the greater command of hand labor? Are they justified, therefore, in producing clays that are accused of not being as good in grade? Can they or can they not be depended upon, and what is the outlook of the industry?

These are the questions that I want to put before you and would like to hear discussed from all sides, for they have a general bearing upon the question of our domestic product.

It goes without saying that if we want the country self-contained by protecting manufacturers, we also want to be self-contained in the matter of producing and using its raw materials. But we do not want manufacturers to take unnecessary risks in the use of those raw materials if the producers of them cannot be induced to produce them right and to give them, as they need it, a product upon which they can depend.

We have large deposits of primary and secondary kaolins in this country and so far as the policy of the country is concerned for those that wish to encourage American industry, and also in the matter of common sense, it will be desirable to make the United States self-contained as far as possible or practicable. For that, all of the interests have to work together.

Inasmuch as the Government made an earnest effort during the war, through the Bureau of Standards, to find out how far, in a case of emergency our country would be self-contained in this raw material, we want to know what progress has been made, whether the domestic producers are on firm

ground, and whether they are defeated by the possible prejudices of long standing.

As the importers are citizens of the United States who have the equal right and protection of our laws it would seem desirable to bring out what progress has been made.

How far can we depend on our domestic product? How far are we really dependent on importations? We should like to hear from the men who are interested in both sides and aspects of the clay industry and furnish the supplies. What have they to say, what has been the experience of technical men and what has been the experience of business men who bring in commercial questions in connection with the matter?

Discussion

Mr. Rusoff: I have had considerable experience with North Carolina clays. In former days, we had little trouble in getting the right quality of North Carolina clays, but in the past few years, due to the tremendous demand upon the clays of which I speak, there has been no question in my mind that the quality of clay has deteriorated to a great extent due to the fact that the pits are being rapidly exhausted and that they may be compelled to turn out a poor product owing to the increased production.

I have had high content of moisture in regard to North Carolina clays and the same in reference to ball clays. One man told me, "The water is mighty good down here. It is better than the water up in your section." For that reason he thought it worth while to keep as much moisture in as he did.

I always felt that 12% moisture was more than sufficient for china clays but I have seen carloads from time to time with as high as 18% and 22% moisture. On top of that, you will oftentimes find a great quantity of mica even on a 200-mesh screen, and also a considerable quantity of iron scale, possibly off their coils in their drying sheds.

I think one thing that the North Carolina producer is going to realize is that he will have to put out a much better product than in the past. This production craze is not going to last and the quality is going to be the big consideration in the next few years.

Chairman Riddle: One of the men just spoke of some of the English clay miners showing our literature and stating that in view of the fact that the Ceramic Society said we need English clays they could keep their prices up.

There is one thing for all of us to bear in mind. No matter who states these things as facts and who reads these discussions (that is, someone on the outside) we must always remember to tell them that these are the opinions of the individuals and you will find in the Society literature

the statement that the SOCIETY is not responsible for the statements made in the *Journal.* Those are the opinions of the individuals themselves. No matter what is said, that argument always holds good, if anybody is trying to use it as a club.

MR. BELL: The Mandle Clay Mining Company which I am associated with mine only ball, wad and sagger clays; that is to say, we do not produce china clays. While we feel that many who are now using the imported ball clays could use our materials to advantage we do not attribute this to any prejudice against our clays. We find the users always perfectly willing to make tests of our clays. We could not ask any more than that. However, in many cases where our clay is not adopted, after tests are made, we believe it is due to the manner in which trials are made. Of course, each factory manager has his own idea about how this should be done.

We cannot make the clay over and have to offer what we find. We select our clays carefully and do not make any mixtures of them. This gives as uniform a selection as can be had by mining each strata separately and by removing visible impurities which are large enough to justify taking out by hand. We believe that any variation in a clay strata could be detected by the eye, though we watch the matter carefully by having numerous trials made throughout the year of each clay we are mining. We believe we are producing very standard selections for we have been selling the same lines for many years. It is reasonable to assume that our trade finds no difficulty on the score of standardization.

Since and during the war we have sold larger quantities of ball clay than before. During the war we were able to place our clays in lines where before it seemed impossible to do so, and since adopting them many have continued their use. There are certain manufacturers using our ball clays exclusively, whereas others making the same line are using only imported ball clays. Others use some of each; thus it seems by fixing the right combination the domestic clays can be used satisfactorily in place of the imported.

We have no complaint on the reception of our clay by the trade, for the increasing demand indicates that our clays are proving satisfactory and we are pleased to be able to assure our customers a continuous supply of our present selections for years to come.

As to the tariff, I wish to say that I do not believe it would help us any in selling our clays unless it should be increased so as to make the imported clays more or less prohibitive. This would require a tariff rate which probably would be considered unreasonable while a low tariff on imported clays would not benefit the domestic producer any and would only impose that much on the customer. There has not been, as far as I know, any concerted action on the part of the domestic producers to get a tariff on imported clays.

DR. LANGENBECK: While Mr. Bell has spoken of ball clays the principle we are after would equally apply to all ball clays and china clays. He touched lightly on the technical point of his clays gaining a foothold and the progress that is being made, but whether that progress is fast enough or not fast enough, is something that seems to me the technical men here should answer. And as I say, I think indirectly that would apply also to the china clay question which is more immediately before us.

Perhaps the Chairman, therefore,[1] will make an appeal to the technical men who have had experience with English ball clays and American ball clays, and who can give reasons why the substitution of the American ball clays is not greater than it is, and whether the slow progress is justified.

Further, it seems to me, it would be of interest to the technical men who are present to speak frankly on a subject like this, because in so conservative a craft as the pottery industry all sorts of minor considerations often thwart a technical man. He ought to have one place where he can open his heart with reference to his profession and probably it will react upon his industry.

CHAIRMAN RIDDLE: Are we paying for ball clays at a price varying in proportion to the bonding power of the clays? And if so, do these tensile strength tests in the raw state pretty well govern the price?

As I understand it, a good many of the English ball clays are considered very strong, and a less amount of them, as a result, is used in the body. If that is so it is one way of approaching the subject.

DR. SCHRAMM: I have had no experience in the use of American ball clays in vitrified ware. We have always used English ball clays.

We have a fixed policy not to change any material unless we can show an improvement in our product as a result therefrom.

MR. CRANE: I have heard you use the word "ball clays" here. I have asked those who use clay what is ball clay? And I have never yet had a definition I could understand.

MR. BRIAN: Ball clay derived its name from the fact that the clay when mined comes out in lumps or in balls, therefore, the English definition for it is ball clay. As the clay is mined it is mixed containing various colors. You can easily count as many as fifteen to twenty colors in the average English ball clay mine excluding, of course, some of the ball clay mines from which the extremely dark clay is produced. This clay will run dark along with some very light colored clay. The light colored clay is weaker in tensile strength than the dark clay.

PROF. WATTS: In surveying the English versus the American ball clay, my impression is that the English ball clay has by many potters been

[1] A. S. Watts, "Ball Clay Specifications," *Bull. Amer. Ceram. Soc.*, 3 [8], 288(1924).

considered more desirable because it begins to vitrify at a lower temperature than the American ball clay, and that it has an improved working property which it imparts into the body over that possessed by the American ball clay. Whether that is the property by which lubrication is imparted, or the property by which increased bonding strength is imparted, or whether it is the combination of the two which particularly adapts it for use in the whiteware body, I am not able to say.

But the answer which I have received from almost every whiteware manufacturer who is wedded to the English clay, is to the effect that he finds that the body has a certain working property when he uses the English clay which he cannot obtain by the substitution of the American ball clay.

No two clays possess the same physical characteristics. They may be identically the same so far as we can determine by chemical analysis, but each possesses an individuality and the man who has been accustomed to working a body with English ball clay in it, notices a distinct change when American ball clay is substituted.

On the other hand I have found many manufacturers who say that they have found that they can substitute a certain amount of American ball clay, and get equally good results. Some of them say they have to use slightly more than they did with the English ball clay; others say that they do not believe that the color that they obtain when they use American ball clay is quite as good as the color they obtained when they used English ball clay.

But within the last two or three years, I have had a great many users of English ball clay say to me that if there is any American ball clay that is any dirtier or any more unreliable than some of the English ball clay, they were unable to locate it.

I believe that the latter described conditions have largely been a product of the former, that is, that we have in the United States, a large number of people who are wedded to English ball clay. That fact, of course, becomes known to the producer of English ball clay, and as the difficulties of mining have become greater to him, labor conditions have become more unsatisfactory, and he has been crowded for shipments, he has undoubtedly sent material over which he would not have shipped if he had thought he could not get his money for it.

It seems to me that the solution of this situation is about as follows: We have in the United States a great variety of ball clays, perhaps not one of which we can substitute for any single English ball clay. We know there is light-colored English ball clay, which is peculiarly adapted to certain work, and dark English ball clay which is considered more desirable for other work, and we know that many of our American manufacturers use a certain combination of two English ball clays.

I believe that we should find out whether we can obtain a combination of American ball clays which will closely approximate the English ball clays or the combination of the English ball clays.

I am convinced that a course of that kind would result satisfactorily. I do not mean to say that you can make a body which you can give to your potter and that he cannot tell from the body which contains the English ball clay. Perhaps he can. Perhaps it would require some change of mental attitude in order to convince him that he could work the body with the American ball clay in it just as successfully as he works the body with the English ball clay in it.

That is a matter that will have to be worked out in the factory.

The problem is one of finding out what the essential physical characteristics are of the American ball clay and of the English ball clay, and ascertaining whether by a combination of the American ball clays which we have, it is not possible to produce something which would be a substitute for the English ball clay. And I am convinced it can be done. It may mean that our ball clay producers will have to determine the physical properties of their ball clays or have them determined and be prepared to show by what combinations they can be substituted. It may mean that the potters will have to agree to have the bodies containing American ball clay tested out in their factories in order actually to establish the feasibility of the substitution.

There is one point that deserves a little special emphasis, and that is the fact that the impression prevails (and it may be correct) that the English ball clay, when incorporated into a body, encourages earlier vitrification than is the case when the American ball clay is used. Now whether an American ball clay exists which will provide this earlier vitrification, or whether this earlier vitrification can be provided successfully and satisfactorily in some other way, remains to be determined.

These are all subjects which will require a certain amount of careful investigation, but I believe that if England was dependent on the United States for feldspar, she would have sufficient consideration for the future of her industries so that she would very carefully determine whether she did not have a home product which could be successfully substituted. I believe that we, as Americans, should display the same attitude.

Mr. Crane: That is just along the line of my thought and seems to me an excellent idea. Instead of asking the producer of clay to bring something to your factory, you men who want to use clay tell the producer the material you want to use, and see if he is able to bring you the stock you want to purchase. Do not ask him to bring something to your factory which you use any way you please, or in any way that you think best. If the product is not what you want, do not blame the poor miner. He is not technical.

Mr. Bell: A question has been asked as to whether the bonding strength of the clay governs its price. Speaking for ourselves only, I will say that it does not. The reason our strongest clay costs the most is because it is overlaid by a bed of lignite and as a consequence costs more to produce. This lignite permeates the clay in places and must as far as is practical be trimmed out by hand. The stronger clays almost invariably have this lignite over them.

Prof. Watts spoke about giving data on clay to help the user. We have a chart about a yard long giving as full data as we have been able to get, on all of our clays. The government has issued a bulletin on English ball clays and a number of domestic clays.[1] Thus the user can procure data on all of the imported and domestic clays for comparative purposes. I suppose Prof. Watts has in mind the use of domestic clay everywhere, exclusively. We get into every line in which ball clays are used and, in a number of places they are used exclusively, which seems to indicate that the manufacturer could get along without the imported ball clay. However, there are many users who do not feel this way about it and thus it is likely that imported ball clays will always be used, but as stated, the data is pretty well worked out for those who wish to try the substitution of the domestic for the imported clay.

Where one manufacturer uses the domestic ball clay and another making the same line does not or cannot do so satisfactorily, it is probably due to some factory condition and therefore comparative data on the imported and domestic clays will not be very helpful. We are always glad to furnish our chart to anyone who is interested and to supply samples of any clay they may select. No doubt the Government Printing Office is in a position to furnish such bulletins as they have prepared on the matter.

Secretary Treischel: The question Dr. Langenbeck has brought up for discussion is one in which he asks the question, "What has been the experience in substituting domestic secondary and primary kaolins for English china clays?" and he includes domestic ball clays for English ball clays.

The Company with which I am associated manufactures electrical porcelain by the dry process, the wet process and the cast process. In the six years I have been associated with that Company we have used seven domestic ball clays, and three English ball clays, three English china clays, and one domestic secondary kaolin. We have also used a small amount of one domestic primary kaolin, which petered out and we were not able to get a supply of it.

We have worked out bodies in which we can interchange these materials to suit our will so that at the present time, we are practically governed by f.o.b. our works.

[1] A. V. Bleininger and H. G. Schurecht, "Properties of Some European Plastic Fire Clays," Bur. Stand., *Tech. Paper* 79 (1916).

Mr. McAfee: I think one consideration of this domestic clay is the reliability of supply. None of us like to change our formulas after we get one that works.

We have had quite a bit of difficulty in the past in getting the same domestic clay, and we seem to be able to get the same English clay with greater ease than the domestic clay. That may be because there is a larger reservoir between the mines and the consumer.

The question of substitution brings out again the necessity of more accurate laboratory control. Dr. Langenbeck has mentioned the possibility of combining primary and secondary kaolins, and Prof. Watts spoke of a definite procedure along this line. If we knew more about what we wanted, in a technical way, and when we had it, the problem would be much simplified.

Mr. Hunt: In our experience we have found that the shipments of American china clay vary greatly from shipment to shipment, and that is not so true of the English china clay; it is more uniform. As to ball clays, a number of American ball clays have large deposits which can be used with success because of their uniformity, which is the great consideration.

If you can adapt your works for a certain clay and the clay changes, you are "out of luck."

When the American china clay is produced in a uniform quality you will find it a more likely substitute for the English china clay.

Mr. Crane: Mr. Hunt says you buy clay, getting it in regularly and if it changes, you are "out of luck." I think he should know what he wants, and when the material comes in he should examine it to see that it is the kind of material he wants to use in his mix. When he has determined that matter, he can use the kind of stuff he wants to use, and he will turn out a uniform quality of goods.

Mr. Hunt: We do know what we want. We want uniformity.

Mr. Brian: I do not know of any importer of this commodity, my company included, that can guarantee any pottery manufacturer in America an absolutely uniform English ball clay. In fact, my company positively refused to make any such guarantee.

We have been in the importing business for the past thirty-two years and the experience has been that English ball clays will vary from shipment to shipment. What I mean by variation in clay is that sometimes the clay will be of a lighter color, other times darker.

English ball clays when mined run various colors, some blacker than others. Our experience has been that ball clay mined by the shaft operation ordinarily is better than open mine working.

I have just had seven analyses made by Dr. Wolfe of the Imperial College of Science and Technology, South Kensington, London. These

analyses covered the light clays, medium dark clays, and the very dark clays. All the samples submitted were from different operations, although the analyses are all about alike. The question is then, what do the analyses amount to except to tell us of the different ingredients therein.

Mr. Gesner and other importers were in this meeting and possibly they can guarantee a uniform ball clay, but I am satisfied that consumers of our ball clay in this meeting can frankly tell you that while we ship them a good grade of ball clay it is not a uniform material. They are satisfied that they are getting the best that can be gotten out of the mines, and I think Mr. Bell will advise you that they are having about the same trouble with ball clays in America. This is referring to the uniformity of ball clays.

Mr. Bell: We mine our clays each strata separately. In addition all impurities are trimmed out as nearly as is practical. This is as close as we can come to producing our materials uniformly.

Mr. Brian: I have asked our producers in England, at an increased price, to separate as nearly as possible the black clay from the light colored clay, and this they are doing. The consumer is compelled to pay the increased cost for the black clay, and the same price for the mixed clay as mined, and the same price for the light clay as for the mixed clay. This is, of course, the light clay selected from the black clay. I likewise ask that the consumers take in a certain amount of the light clay, as the producer in England insists upon my company taking both the light and the dark clay. By this separation this company has as near a uniform article as is possible. This selection enables the manufacturer in America to better gage his mixings insofar as English ball clay is concerned.

Mr. Gesner: We do not guarantee a uniform English ball clay. We cannot maintain it. They take it as it is. With the development of technical science there has been a corresponding increase in the demand for English ball and china clays. That is good enough for me. If you, who have technical knowledge with your combined intelligence, can work out a process of teaching the clay miner to develop what you need and improve these domestic clays, perhaps that would solve the problem. We hope you will not succeed in doing so. We do not gloat in your misfortune, but we take it for granted you buy our clays because you need them, and we are very much obliged for your patronage.

Mr. Fritz: The statement that Mr. Brian made that English ball clays are not absolutely uniform, I think can also be made relative to American ball clays, only to a greater degree. Prof. Watts' statement is true, that American clays will not vitrify at as low a temperature as English ball clays, and also do not have quite the bonding strength.

I have examined a great many American ball clays, and I can count on my hand those which will even approach the English ball clays in vitrifica-

tion temperature and bonding strength. None of them equal the English ball clays in vitrification, but I have found two that do equal in bonding strength. These two clays are vitreous at cone 10 but the vitrification does not begin at as early a temperature as the best English ball clays. This fact together with the greater non-uniformity of the American clays makes the use of these clays not as safe as the English. It simply means that you do not have the safety factor with the American ball clays that you do with the English clays. The latter will vary a little, but you still have vitrified ball clay at cone 10 and you will also have a more uniform bonding strength over a period of time. This, we feel, is important in our wet process electrical porcelain work.

If we could get these American ball clays more uniform, so that they would be closer to their best, at all times, then we could use them without any trouble. We have been able to produce porcelain with these two particular kinds of ball clays, which have the properties that are practically equal to the English ball clays, and the porcelain as far as we can test it is just as good as what we have made with the English clays.

It may be that adjustments can be made so that these natural variations will not affect us, and it is toward that end that we are working.

I hope we can work it because I would like to see our country use its own products.

If you do not need a low vitrification temperature or very high bonding strength, there is no trouble in using the American ball clays, for there are many that will adapt themselves under such conditions. In manufacturing dry press electrical porcelain, we can use ball clays of that type, and we therefore use several American ball clays without any trouble. The only governing factor is price, just as Mr. Treischel explained.

That is all that I can offer at the present time. We are working on it and I hope I can present something more definite by next year.

Mr. Gates: In our terra cotta business, we do not wait for the architect to come and tell us what kind of terra cotta he wants. We have to show him what we can make and if that is not right for his use, we have to make it right for his use.

I feel that the clay industry of this country is dependent largely on the energetic action of the men who are digging the clay and marketing the clay and hunting out the requirements and needs of the different potters, and adjusting their clay if it needs adjustment, handpicking it if it needs handpicking or washing it if it needs washing, and getting it so that they can come to you and back up their material and say, above all things, that every carload you order will be identical with the last carload shipped. If we can get our clay industries in that condition in this country, we will not have to go abroad for clay.

Dr. Langenbeck: I think we should insist that the technical men give

information in the way of tangible standards that can be put down into direct description of physical properties, accompanied by figures.

This is, of course, a fickle product, an elusive one, and even Prof. Watts is not prepared to say that we can define in this way as yet in a positive manner. But we certainly have to make progress in that direction, and it is up to the clay producers, if we give them a hand in that direction, and it is more up to the clay consumers to give them a hand.

The clay consumers have reached a point where they have technical men and are employing them now. The necessity of that has not been made obvious to the producers.

As soon as you technical men make an approach, no matter how small, in that direction, of giving facts that are tangible in temperatures and percentages of these subtle properties of clays that are not shown in the ordinary mineral analysis, the two groups will approach each other. That was partly my hope in starting the original trouble of putting chemistry in the clay industry, although it has made a profession for a good many of you.

I hope that you technical men here will rise to the occasion better than you have done so far, and say, if you reject the clay from your works because it was not uniform with the last shipments, "What tests did you make? What tangible figures have you tried to get, so that if it were a matter of law you could show, and not a matter of opinion?"

Now what tests have you made privately, to satisfy your own scientific conscience, to approach a little in the direction of this tangled solution that Prof. Watts has spoken about? Some of you may have made other tests, maybe only qualitatively, but the straws show in which way the wind blows in finding our way through the maze of this elusive plasticity and its coördination with a wide vitrification range that will make your body immune to these different temperatures so that you will still get a good electrically resisting porcelain.

Will some of you give some of your private experiences or some theories that you are working on in order to approach this subject? You may not have been able to carry it out as you thought you could, but somebody, if you mention it, may recall something they have done in that line. That is how we get our ideas from the articles that appear in the journals. We read the *Journal* diligently, not to find the man who has solved the problem, but who has met a difficulty similar to our own and probably failed. So you say, "Well, that part is done. I do not have to repeat that. I am going to attack it from this angle."

Professor Watts: The question of color has been raised once or twice, and I am increasingly impressed with the fact that in many lines of whiteware manufacture, there is a feeling that the American market is favoring some other color than dead white.

I was talking with an importer. He was telling me that there seemed to be a decreasing demand for the dead white porcelain of Continental Europe. If that is true, it means something. It means that there is a possibility that the extreme whiteness, which at one time we demanded in our china clays, may not be as vital as it was.

Perhaps it would be worth while for the American manufacturer to consider whether, collectively, the color of the whiteware could not be changed to a very pale ivory. We know that the wonderful beauty of the Lenox ware depends not on its perfect whiteness but on its other properties, and while they are difficult to define, nevertheless its excellence is recognized.

I believe that the color problem is not as big a problem as it was a few years ago.

I do not believe it is going to be possible for a good many years for any manufacturer to say to the man who supplies his clay, "I want a clay with a plasticity value of Pi-4-B." I do not believe he is going to be able to supply that if it is called for. He might have to offer a clay with values "Pi-5-B" or "Pi-5-A."

I do not think there is a manufacturer here but would have a headache if he would try to state how many clays he has tested out in his factory to see if they met his requirements. All of the manufacturers are testing them all of the time, and while they may not be able to express exactly the combination of properties that they want, in numerals or percentages or any other values, they test them all and they find the one which most nearly approaches the one they desire.

Now, as I brought out in my paper,[1] I believe in specifications of ball clay. There is a grave mistake being made by the testing of clays, or any other ceramic material by themselves. I have harped on that until I guess I am pretty well recognized as an advocate of only testing the material in the body in which it is to be used.

A great deal cannot be told by firing a material by itself. It must be incorporated in a body in which you are going to use it. Especially in whiteware bodies. There should be no hesitancy on the part of the manufacturers in testing a ball clay in a body of stated composition. The one I recommended was 20 of standard feldspar, 30 of standard flint, and 50 of standard clay. You can make it 30 of china clay and 20 of ball clay substituting for the other, the material which you are testing. You can say to the man from whom you are buying any of your materials, "The sample marked 1 is the way I want it. Your material is substituted in the sample marked 2. This body cracks or this body warps, or this body does not vitrify, and this body is bad color."

[1] *Bull. Amer. Ceram. Soc.*, **3** [8], 288 (1924).

There are a dozen things we can say about it after we have made the test, but the man who ships the clay must not say to us, "Well, tell me how to fix my clay." He must remember, of course, that if his clay will not do, if I am not satisfied with the clay he is shipping me, he must offer something else, and if he does not offer something else, I am certainly going to buy the best I can get from somebody else.

Dr. Langenbeck: I think this is excellent ground and also that further work in analytical determinations will also lead to the use of symbols that will mean something definite.

You have heard from Mr. Bell, I think, that the strongest and best clay he makes, he gets the highest price for, and he is modest in saying that he asks the highest price only because it costs him more to mine it.

I want to coördinate, and I want to get you into the habit of coördinating these chance remarks, and see what they mean, chemically, with what was said by Mr. Brian. I believe in his endeavor to get the English manufacturers to separate the light clay from the black clay.

I was the first ceramist to develop the American ball clays. Samples of my original ware can be seen if you happen to be in Kentucky at the State House at Frankfort, in the museum there. That was the first American ball clay gotten out. I got it out and shipped it to Cincinnati to the Avon Pottery. When I was with the American Encaustic Tiling Co., and other companies a number of years afterwards, I also introduced its use in a definite mixture of light and dark lump, just exactly as Mr. Brian has described the English clay.

I separated that, myself, for particular uses, and I found, as Mr. Brian has described, that the stronger clay and the clay with the longer vitrification range, was the black clay.

I coördinate that with what Mr. Bell said. What is that black stuff that is in the clay? You may put down in a vague way, "Organic matter and loss" in your analysis. But it is vital to know what that is.

That black matter to some degree probably infiltrates from the lignite Mr. Bell has spoken of into his strongest clay. In other words, it is what the dirt farmer calls "humus."

The trouble with our Ceramic Society (if you will pardon me for criticizing you) is that you sit in a water-tight compartment—you are not taking enough notice of other people who are also dirt farmers and working with clay for their own particular purposes.

Now in order to get one of these factors represented by a symbol or whatever you want, or at least another item in your analysis of a clay that is not a mineral, supposing you do what the agricultural or soil chemists are doing, determining the humus in the clay, and then see if the proportion of the humus is not a factor and an important factor in this matter of plasticity, and possibly also further in this range of vitrification.

Now let me suggest to you who are earnestly engaged in the analysis of clay to add humus. In Wiley's book on "Soil Analysis and Agricultural Analysis," you can find methods of doing it. It is perfectly simple.

This will give you one more item in your analysis of the clay, and maybe it will run to something of value.

Mr. Twells:[1] Through reading over the discussion on this subject I have received the following impressions as being the composite opinion of the various speakers. English ball clays compared with American ball clays: (*a*) are more uniform; (*b*) give a better color to a body; (*c*) vitrify at a lower temperature; (*d*) have a better bonding strength in the unfired state, and (*e*) give better plasticity or working qualities to a body. On the other hand there seems to be a general complaint that the English clay miner is not playing fair, *i. e.*, that he takes an advantage because he believes that we have to have his product; he makes us take the grade of clay which suits him best, he soaks the clay to the maximum with water, and then charges his own price. For this reason there has been for several years an earnest desire on the part of many to utilize American ball clays in our whiteware bodies. My own personal sentiments favor this course and I wish to point out some ways by which I believe it can be done successfully.

In regard to uniformity, the importers of English ball clay, who have spoken, agree that it is not uniform and that they cannot guarantee its uniformity. Moreover, as Professor Watts has pointed out, it is undoubtedly true that some of the English ball clays are dirty and unreliable. At the same time we must also admit that American clays are not strictly uniform—each car the same. This brings me down to the point I want to make. That all clays whether English or American are not uniform as they are received at the pottery. But they can be made so with relatively little cost by observing simple rules in unloading, storing, and withdrawing the materials at the plant. It is not a difficult job and the remedy gives positive results. This phase of the subject I have already discussed in a paper given before the Whiteware Division at this convention.[2] Again, how many plants make a practice of making up a trial run of body out of each new bin of clay, in order to get a sample lot of that ware out of the kiln before the bin has to be used? Relatively few plants go to that trouble and yet it might often save a lot of money regardless of what kind of material was in the bin. If the advance test indicates that a material is different from that in previous bins, might it not be possible to make a small correction which would right the difficulty before a large amount of ware is made and spoiled? It is no doubt true that there is plenty of room

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[1] Received April 10, 1924.

[2] "Handling and Storing Raw Materials to Produce Uniformity in a Body," *Jour. Amer. Ceram. Soc.*, **7** [2], 82 (1924).

for improvement in the methods used by the American clay miners; yet I believe that if those who complain about the lack of uniformity in American clays will check up, they will find their chief trouble lying in their own plant processes.

That English ball clays vitrify at a lower temperature I admit, but I feel sure that the composition of the body could be altered slightly to make up for the differences in the American clays. I agree with Professor Watts that a clay should be tested in a body as well as alone. But I disagree with his suggestion of testing it only in one standard body or in whatever body happens to be in use at a plant when the sample or car of clay arrives. I do not think it fair to condemn a clay solely because it might fail to give good results in one particular composition. I know from experience how common a practice it is in a plant to attempt to substitute one clay for another without scientifically correcting the body to compensate for the change. For example a plant runs out of English ball clay; some one failed to order it in time or the car was delayed; there is a bin of Tennessee ball clay at hand. The slip room foreman or the superintendent has the one substituted for the other and we all know the result. There is trouble all through the plant. Everyone forever after condemns Tennessee ball clay and says that only English ball clay can be used. It would seem fair to condemn a clay only after it had been tested in a considerable field covering a wide range of different compositions. The trouble usually lies in the fact that we do not, as a rule, work the problem out carefully in the laboratory, or if we do work it out carefully in the laboratory, we let it rest there and do not apply the results scientifically on a large scale in the plant.

Regarding the color produced in a body by American ball clays, as compared to that by English ball clays, I agree that taken as a whole the English ball clays give the better color. But I have tested a considerable number of English and American ball clays in whiteware bodies in direct comparison and I have found that some brands of American ball clays give as good a color as the best grades of English ball clay and even a better color than other grades also sold as first quality. Of course some brands of American ball clay do give a body a distinctly creamy-white color but this, as pointed out by Professor Watts, may be less of an objection in the future than at present.

I also agree that English ball clays give better plasticity and better bonding strength to a body. Professor Watts mentions that some manufacturers have overcome this defect in American ball clays by using slightly more of the clay. He also suggests that a combination of ball clays may serve the purpose. I would also suggest that a very small percentage of bentonite be tried along with the American ball clays to help develop the plasticity. Professor Cox has shown us at this con-

vention that with a small percentage of bentonite he can make a North Carolina kaolin as plastic as a Kentucky ball clay.[1] This would seem to indicate that with bentonite we could develop any degree of plasticity required.

Personally I agree with several speakers that American ball clays can be used. I feel sure of this because many plants have used them successfully for years. The fault as I see it lies chiefly with the ultra-conservativeness of our craft. Several speakers have already referred to this. We dislike to adopt new methods and use new materials. I cannot agree with the policy that the only change warranted in a body is one which will result in an improvement in quality of the finished ware. I, too, feel that we should not lower our quality, but if we can produce a quality equally as good using cheaper materials and materials of American origin, we are justified in doing so.

DISCUSSION[2] ON "EFFECT OF MUFFLE ATMOSPHERE ON FIRING ENAMELS"[3]

Mr. Vollrath: What type of furnace was used in the large scale calculations?

Mr. Cooke: That was the muffle furnace.

Mr. Schwier: Do the firing racks used in support of the furnace have to be taken into consideration besides the amount of ware being fired in any furnace?

Mr. Cooke: There is no question but what this is true. The oxygen will be absorbed more or less by the firing racks, depending on the sort of equipment used. But as far as I have gone, it is very problematical whether there is any calculation referring to any large full-sized furnaces which is at all accurate. Whether or not any inaccuracy comes in by not taking into account the firing racks, it would not be considerable.

Mr. Hansen: Mr. Cooke has shown very clearly that a certain amount of iron oxide on the sheet is necessary to get the enamel to work properly. I just wondered whether the introduction of iron oxide in the ground coat, just as we have our cobalt and manganese, would give the same effect. I have seen a combination of iron oxide and cobalt used, and I wondered whether oxygen was necessary in that case.

Mr. Cooke: I have not tried that just as you have put it. But taking into account the quantity of iron oxide formed as a film in proportion to the weight of the enamel the percentage was rather high. And I doubt if

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[1] Paul E. Cox, "A Study of Plasticity by Practical Potters' Methods," *Jour. Amer. Ceram. Soc.*, **7** [3], 5 (1924).

[2] Presented at Atlantic City Meeting, Feb., 1924 (Enamel Division).

[3] R. D. Cooke, *Jour. Amer. Ceram. Soc.*, **7** [4], 277–81 (1924).

the same effect could be gained by adding that much raw oxide to the enamel without disrupting the formula.

Mr. Vollrath: Was the material used in those grates cast iron?

Mr. Cooke: Our regular equipment was not used in the experiments. The calculation for standard ware in the standard furnace is purely a mathematical problem. No experimental work was done in our furnaces.

Mr. Landrum: As I understand it, from your calculations there will always be plenty of air. Am I right?

Mr. Cooke: No, not necessarily. Experimentally I found that six cubic inches of air to one square inch of enamel surface was about as low as you could go in air capacity. And by making a few calculations I found that that limit was often dangerously approached in practice.

Mr. Landrum: We find these data very interesting. Blistering occurs while the ware is cooling. If enlarging the furnace or introducing air will assist, we have here a real practical suggestion.

These data will be especially interesting to those who are considering the feasibility of a continuous furnace, of a furnace that will have just as little air space in it as possible in order to conserve heat. It looks as though air will have to be introduced along with the ware; *i. e.*, have a circulation of air.

Mr. Sweely: Mr. Cooke, did you find any detrimental effects from having too much air?

Mr. Cooke: No.

Mr. Poste: Some work that we did some time ago might be of interest here. Our problem was to substitute oil for natural gas as the fuel in a direct-fire enamel furnace. In the first place we asked ourselves the question what are the essential conditions by way of atmosphere in a direct-fire furnace? Having answered this we next reproduced the conditions in the oil-fired furnace.

Our findings apply to our particular furnace and enamel. Probably the quantitative conclusions would not apply exactly under different furnace and enamel conditions. The general principle should hold, however.

We found that with from three to four per cent free oxygen in the gases in contact with the enamel we encountered traces of the trouble that Mr. Cooke has in mind. With the oxygen down to 2% serious trouble resulted. With oxygen at 5% we had no trouble. We concluded that 7% could be taken as a safe working requirement.

We then worked out a system of controlling our oil burners so that we realized about 7% oxygen in the furnace atmosphere and no trouble comes as long as these conditions are maintained.

Mr. Cooke: I might mention another source of error in firing hollow ware. We have more air really than the actual capacity of the muffle

would indicate, because as hollow ware goes into the furnace it carries with it cold air in the interior. When it becomes heated it expands to some 2 or 3 times its original volume, which gives considerable excess air. That would not apply to flat ware.

Another thing: We one time experimented with a semi-muffle furnace, gas-fired, and found that we always got this ruffling or fine blistering with ground-coat enamel but were very successful in burning cover-coat enamel.

Mr. Lindemann: I should like to ask Mr. Poste whether he had that same effect with cast iron as with steel.

Mr. Poste: We have never worked with cast iron at all in a direct-fired furnace. That was sheet steel altogether. I wonder if there are any observations relative to cast iron.

Mr. Bardush: Mr. Cooke referred to the ground-coat blistering. I had that about five years ago and plenty of it with producer gas. The only way I could overcome it, was to fire the ground coat about half, take it out, chill it and put it back again. By this means I got rid of it.

That was too much work. I commenced to treat my coal before firing into the gas producer. Instead of yellowish gas, I obtained a bluish gas. I had no more boiling or blistering.

You have the very same thing with a direct-fired furnace with a poor grade of coal. I had it not long ago.

Chairman Staley: With what did you treat the coal?

Mr. Bardush: With calcium chloride, twenty dollars a ton.

Mr. Jaeger: Mr. Landrum has drawn attention to the danger of building too low a furnace or a furnace of very shallow depth from the bottom to the top of the muffle. About six months ago, we started to operate a furnace the spring of the arch of which is about eighteen inches from the bottom. We have benches that support the ware racks which are about eight inches high. If there was a danger of not getting enough fresh air we are about as close to the limit as we can get. After an operation of six months we think we are getting very good results. We have not observed anything that would raise a suspicion of insufficient air. And we have been firing flat-ware enamel during these six months.

Mr. Manson: I was interested in what Mr. Hansen asked about adding iron oxide as such to the enamel itself, because it is a rather common practice among sanitary ware men to add a little iron oxide to the ground coat. They think that it makes it easier for the coater to see whether he has his casting covered. But I have always wondered whether they might get some beneficial effect from it which they did not know anything about. I am trying to find that out myself.

Mr. Vollrath: What was the over-all height of that muffle, Mr. Jaeger?

Mr. Jaeger: I think it is eighteen inches and I think the arch is about seven inches from the spring in the center.

CHAIRMAN STALEY: Mr. Cooke, there is one question. Would you say you get blisters when you do not have iron oxide present?

MR. COOKE: No.

CHAIRMAN STALEY: Well, what makes the blisters?

MR. COOKE: I should like to ask that myself.

CHAIRMAN STALEY: I could understand how iron oxide could make blisters by giving up oxygen, but I do not understand how lack of iron oxide could make blisters.

MR. COOKE: I tried to determine that in the analyses of exhaust gases from the furnace. I was looking for some foreign gases that were not in the air that went in, but I did not find any. If this blistering was caused by the evolution of a gas either from the surface of the steel or from the enamel, it did not escape into the surrounding air in any sufficient quantity to be detected by analysis.

MR. LANDRUM: Practically all formulas for ground coat either contain nitrate of soda, nitrate of potash or manganese dioxide. I suppose you have tried these one by one.

When all of the oxidizing agents are left out of a ground coat I find it is inclined to blister. Although a ground coat can be made without oxidizing agents in it, still a more fool-proof enamel is made with oxidizing agents. Therefore, in most of these enamels we still find these nitrates. Although these are put in at the smelter rather than at the mill their oxidizing effect is still there.

MR. POSTE: On that point, I have tried experimentally to leave out the nitrates in a ground coat having nitrates in the formula. As a result metallic cobalt, actually identified chemically, plated out on the steel stirring rod used in stirring the smelt in the crucible.

MR. LANDRUM: And when you used nitrates it did not happen?

MR. POSTE: No.

MR. COOKE: Of course, we know of the oxidizing power of the nitrates and probably most of the manganese dioxide is exhausted in the melting. I did not bring any figures as to the oxide formed on the steel under the enamel, but roughly I made some calculations to see if some oxidizing agents could not be added in the mill during grinding. I found that to get the oxygen which is equivalent to the weight to iron oxide formed, it would be necessary to add something like thirty per cent of manganese oxide.

CHAIRMAN STALEY: Mr. Cooke brought out the important thing about the iron oxide film. It is a physical rather than a chemical effect. The fact is that when the steel is covered with a thin layer of iron oxide the enamel wets the iron oxide, spreads out and attaches itself to the steel. When it is not covered with the iron oxide, it draws up into beads. The iron oxide acts not only chemically, but also physically. If you have the

same amount of oxide present mixed with the enamel it would not stop the beading and pulling up of the enamel.

MR. SWEELY: It is rather interesting to note that if the metallic oxides are omitted from the average ground coat and applied to a piece of steel, the fire required to make a smooth coat is very much decreased. I was wondering whether Mr. Cooke had experimented with anything along that lime—omitting the cobalt and metallic oxides.

MR. COOKE: No, I have not.

MR. SWEELY: I found with a glass that requires three minutes to mature on a sheet of 20-gage steel, the glass free from cobalt can be fired in about half this time without blistering or pin holes or anything of the sort appearing. If there is a reaction between the cobalt and the steel this is a possible explanation of the reoxidation of the steel. That is just a suggestion.

MR. SCHWIER: On your ordinary equipment you will find you cannot go under Mr. Cooke's estimate of six cubic inches for one square inch of surface. We have an electric furnace which is twelve inches to the spring line of the arch and seventeen inches to the top of the arch. By taking the volume on the basis of twelve inches high all the way across, we still have about two hundred and thirty cubic inches per square inch of enamel surface. So you cannot have the hole in the furnace much smaller than that and still get your fork in, raise it and bring it out again. That is about as small a muffle as you can get. The ware would have to be laid on the flat rack much lower than the present firing points to bring it anywhere near the figure Mr. Cooke mentioned.

MR. KORMAN: With regard to iron oxide, I had what I thought was iron oxide on a casting both on the ground and the enamel. The enamel seemed to draw away from the iron spot.

MR. LANDRUM: If the black shape is not cleaned before putting into the furnace, the enamel will crawl; however, I believe Mr. Cooke has a patented process of oxidizing the sheet and does not have to pickle it. Am I right, Mr. Cooke?

MR. COOKE: Yes. It is the same story. You supply the oxide film before you enamel it. And you and I know that the oxide film is absolutely essential. So if there is nothing but oxide on the steel to start with, why should it be removed and then put back on again?

MR. MANSON: In line with what Mr. Korman stated, it is possible to enamel cast iron with a dry process without a ground coat and get a perfectly smooth piece free from blisters. But when I say without a ground coat, I mean that I did have a ground coat of iron oxide on a piece. I have made many pieces in the laboratory.

I have never been able to enamel a piece of cast iron without a ground coat when the iron was cleaned. When I took a piece of cleaned iron, wet

it and let it stand until I got an even coat of rust on it, I had no trouble enameling it without blisters.

CHAIRMAN STALEY: That is, with comparatively high temperature?

MR. MANSON: About 1650°.

CHAIRMAN STALEY: It is well known that cast iron can be enameled by the wet process without a ground coat if you keep your temperature down quite low, that is, below 1250°.

MR. MANSON: That is not only done in the laboratory. I have enameled closet tanks in the factory by the same method. Of course, it is much more simple to use a ground coat. And I do not think a little iron oxide on a casting would have the result Mr. Korman described.

MR. KORMAN: It may be possible that these two men have different processes whereby they are able to do that and get away with it. I do not see why one should disclaim the possibility of a perfect enamel when the whole casting has a film of oxide simply because iron spots cause crawling.

MR. MANSON: Spots of iron oxide might not be very thin whereas a film of iron oxide closely held to the iron is thin.

MR. COOKE: We should not let any confusion remain as to exactly what we mean by iron oxide in this discussion. What I have been talking about all the time is heat oxide or the blue surface we get from heating metal in the air. There appears to be some idea that I might have referred to a coating of rust. I know nothing about the effect of rust.

MR. ANDERSON: We do exactly what Mr. Cooke here claims, every day in the year. We are making hundreds of pieces without pickling. We put this film of oxide on the article by heating and it enamels just as well as with pickling.

CHAIRMAN STALEY: Do you mind explaining just how you do it?

MR. ANDERSON: We do it the same as if we were scaling it. We do not use much heat but just barely enough to blue it. We then dip it into the ground coat and fire it.

MR. COOKE: Is that cast iron?

MR. ANDERSON: Steel, not cast iron.

MR. SCHWIER: May I ask how you get the shop oil off from the piece?

MR ANDERSON: We put the piece into the furnace and then remove the scale. This gives a film of oxide. Then we dip it and fire it in the regular form.

CHAIRMAN STALEY: You do not clean it after scaling? You simply scale the piece in the ordinary manner? What if it has a rather thick film of oxide?

MR. ANDERSON: We do not allow that. The material that comes to us is what they call common rolled stock. It is not regular enameling stock. It is not very good stock either.

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

Questions

1. Does the grinding (coarse or fine) have anything to do with the resistance of a fire-clay brick to spalling?

2. What difference is there between the properties of a soft mud machine-made and a hand-made brick?

3. Can an iron-free clay brick be made for blast furnace service?

4. Will results in service justify the expenditure and added cost necessary in order to make fire-brick mixes from definite percentages of definitely sized clay grains?

5. What effect do soluble salts (such as show on red burning clays as scum) have on the refractoriness of fire brick? Are the silicates formed with such salts in firing of low refractoriness?

6. What effect do sand and air inclusions (commonly called sand cracks or molding cracks) incident to hand molding, have on the service of hand-made fire brick?

7. What is the cause of rapid failure of fire brick in the checker work baffles of oil-fired boilers, subjected to a temperature of 2300°F but against which the oil flame does not impinge? The failure consists of premature vitrification and carbonizing with subsequent fusion. Is this a result of subjecting the brick to a reducing atmosphere?

8. What is the reason for the more rapid failure at a lower temperature of fire brick subjected to reducing atmosphere than will obtain with the same brick under oxidizing conditions?

9. What is the relative spalling tendency of fire brick under reducing and oxidizing conditions, respectively?

10. At what temperature does fire clay break down into sillimanite and quartz? Are the crystals thus formed actual sillimanite or are they the newly discovered mineral $3Al_2O_3 \cdot 2SiO_2$?

11. What properties should a clay brick possess to give good service in rotary cement kilns?

12. What properties should a clay brick possess to give good service in vertical shaft lime kilns?

13. How can the water content for wet pan charges be gaged?

14. What simple laboratory tests can be used to keep the quality of refractories up to standard?

15. What is the cause of the swelling of fire brick in the hearth and crucible of a lead blast furnace after the furnace has been blown out and is allowed to stand idle?

16. Will a high alumina brick resist metal absorption in a lead furnace? If so, what is the minimum alumina content required in such a brick?

17. What is the best type of refractory for lead blast furnace work?

The effect of coal ash on refractories. J. J. Brennan. *Combustion*, **10**, 418–22 (1924).—The metallurgical point of view is adopted wherein the ash from the coal and the furnace lining are compared to a smelter charge and lining. Chemical analyses are given of 9 coals and their ashes and of 14 bricks, Fe-free. Mixtures of 70% ground fire brick and 30% coal ash were prepared, each brick in combination with each ash, and molded into triangular cones, inclined at a 45° angle with the horizontal. These were mounted on slabs of highly refractory material. Similar cones were prepared from each ash and from each brick alone. These were heated in a gas-fired furnace in a reducing atmosphere; four hours were required to reach the maximum of 3000°F. The condition of the cones was observed at 20° intervals. The temperature of the initial deformation of the cones, *i. e.*, when the tip assumed a horizontal position, was noted and

the results were plotted. In the majority of cases, actual life of furnace linings follows closely the indications given by the charts. J. F. B. (*C. A.*)

Discussion

This is an excellent paper and shows the result of a great deal of painstaking work. It is regrettable that Mr. Brennan was unable to include the analysis of all the brick tested. An interesting point is that the relation between the composition of the coal ash and its destructive properties is not at all definite. In a general way the total of the Fe_2O_3, TiO_2 and CaO is a measure of the activity of the slag. Between the composition of the brick and its resistance to the ash, there is even less agreement. When the alumina of the brick is plotted against the fusion point of the brick-ash mixtures there is no semblance of a curve. There is tendency for the fusion point of the mixture to rise with increased alumina content of the brick, but it is only a tendency. The following diagram shows the alumina content of the brick plotted against the fusion point of the mixture of brick and Kentucky coal ash. The other ashes were even more erratic.

It must be remembered, however, that slag action is the product of two factors, namely, chemical action and erosion. The test used by Mr. Brennan measures only the chemical reaction. It is probable that in many cases, low resistance to erosion would more than offset the advantages of good resistance to chemical action. There is reason to believe that resistance to slag action is affected by the texture of the brick as well as by the composition. The most rapid destruction is obtained when particles of the brick loosen and float off in the slag. These particles might have an excellent resistance to the fluxing action, but if the nature of the brick is such as to allow them to escape, it avails nothing.—ROBERT F. FERGUSON, Garfield Fire Clay Co., Bolivar, Pa.

In the August number of the Question Box a statement of the service conditions of refractories in oil-fired boilers using topped Mexican oil for fuel was given. Mr. Ferguson, upon reading the Editor's remarks presented some information on the presence of large percentages of titania in fuel oil slags. This was published in the September number of this department. The work of Brennan, who studied the effects of coal ash on refractories as described above, was reviewed at the same time. It appears to the Editor that fuel oil residues and coal ash must bear a close resemblance. Brennan found high titania compounds in his studies of coal ash-brick mixtures, but he did not carry his work to its final conclusion. He merely wished to establish a relation between fusion points of brick-ash mixtures and service of brick in the boiler setting. Readers are requested to review the August and September numbers of this department and submit further discussion of the problem. The Editor has a copy of the Brennan paper which will be forwarded to anyone interested upon request.—ED.

Correction.—In the September issue of the *Bulletin* on page 352, I note that you give the fusion point of tridymite as 1670°C, and of cristobalite as 1625°C with acknowledgments to Searle. It is my understanding that Searle did no original work in this connection, but that his figures were copied from the reports of others. In a

paper, "The Melting Points of Cristobalite and Tridymite," by Ferguson and Merwin,[1] you will find a review of the work which has been done on this subject and a description of the work done by the authors. These figures are undoubtedly the most accurate of any available. They determine the melting point of cristobalite as 1710°C ±10°, and of tridymite as 1670°C ± 10°.—J. S. McDowell, Harbison-Walker Refractories Company, Pittsburgh, Pa.

In the October issue of this department the question, "At what temperature does fire clay brick break down into sillimanite and quartz?" was presented together with short discussions.[2] The paper deals with calcined clays but gives definite temperatures at which sillimanite is first noted in flint fire clay and plastic fire clay, and temperatures at which the crystals are fully formed. The quartz particles disappear with increase in temperature.—Ed.

Question

What is the best type of fire-clay refractory for rotary cement kiln service?

Discussion

Service in the hot zone of a rotary cement kiln is severe and each installation is a distinct problem in itself. Liners used should have a high melting point, a low coefficient of expansion, be resistant to abrasion at high temperatures and resist the attack of hot clinker. A brick which will carry a coating of clinker is desirable in most instances, although there should be no tendency to build up this coating to restrict the size of the kiln.

Certain cement plants have difficult raw mixtures to handle and the kiln liner must be of a very much higher quality than is required in some other plants. Burning temperatures are higher and the service on refractories much more severe in these cases.

There is practically no problem connected with the cold end of a cement kiln, except that a brick suitable for dry feed will sometimes not give satisfaction with slurry feed, but a medium grade of brick can be found which will serve in one case or the other. In the central portion of the kiln, the preheating zone, a good grade of fire brick is easily found to meet the conditions.

A southwestern cement plant has used three different kinds of hot zone liner. Two of these with fair success, the third with exceptional results. Analyses of the three brick are given in the accompanying table.

The far-western and the Missouri brick gave fairly good results as hot zone liners under rather adverse conditions of high temperatures and active ingredients of the cement mixture. This Company burns its clinker harder than the average and their products will stand outdoor storage for many months without deteriorating, which is an extraordinary thing in cement

[1] *Amer. Jour. Sci.*, **46,** 4th Series, 417 (1918).

[2] See H. M. Kraner, "Sillimanite Development in Some Typical Clays," *Jour. Amer. Ceram. Soc.*, **7** [10], 726–34 (1924).

	Far-western brick[1]	Missouri brick[1]	High alumina brick[2]
SiO_2	56.63	53.80	20.44
Al_2O_3	37.80	41.56	73.10
Fe_2O_3	1.07	2.16	2.09
CaO	2.90	1.12	.27
MgO	1.03	1.08	.13
Alk.	not det.	not det.	.79
Titania	not det.	not det.	3.63

(NOTE: Analysis of high alumina brick furnished by cement chemist showed about 10% of lime, which was checked and rechecked from original sample. New sample should have been taken from interior of brick. This brings up a point in shipping brick as well as one in analysis methods. Brick should never be shipped in a car contaminated with lime or other foreign materials. Brick loaded in the bottom of such a car naturally pick up more or less lime in the movement of the shipment and are liable to give a compromised service on account of the presence of such foreign materials in the surface of the brick. Samples for analysis should always be taken from the center of the brick. This point should be stressed by the manufacturer when he is discussing brick service with his customer.)

plant annals. These brick are both satisfactory for preheating zone and cold end of kiln, and one or the other is used when replacements are required. As hot zone liners they did not measure quite up to the requirements and the high alumina brick was installed for test. The first run of 5 months and 5 days showed a decided improvement in results and service over the liners previously used and the Company has adopted the high alumina liner as standard for the hot zone.

One of the striking things about the high alumina liner is the fact that in the 5 months' run a slight coating of clinker adhered to the brick, but on shutting off the kiln the coating was easily scraped off from the liners without apparent damage to them. There was absolutely no sign of fusion, no slagging, and no erosion worthy of notice. The only sign of trouble of any kind was a chipping of corners of the brick in a few courses due to unequal distribution of pressure. The kiln is of unique design and has improved the burning conditions very materially. It is larger in diameter in the hot zone than it is at the discharge end or throughout the preheating zone and cold end. As a result of this widening of the circle the brick have to be cut on the job to fit and the first installation was not as carefully cut as the second will be. The plant superintendent now understands the value of perfectly fitting circles and will see that the necessary time and expense is put on the next lining to insure the lining against failure due to chipping of corners. The kiln was taken off to replace old liners at the discharge end and to observe the condition of the high alumina lining.

It would appear from the service the high alumina liners are giving in

[1] Analyses by cement chemist.

[2] From *Brick Manufacturer*.

this instance that the ambition of the cement engineers may be reached in the near future: a cement kiln with an insulated lining. The shape of the hot zone of this particular kiln gives very much the same results that the insulated lining is expected to show. There are certain water-cooled rotary kilns in use in other countries which are intended to make possible a higher burning temperature, but this type of apparatus is difficult to handle and expensive to operate. The enlarged burning zone makes possible a higher burning temperature without imposing serious service on the high alumina liner and it is still the simple type of kiln.

One of the things noticed at this plant which is not considered good practice is the outdoor storage of refractories both for boilers and cement kilns. The action of frost is not feared to any extent although there have been occasional lapses from normal weather. There is a rainy season when it pours down in bucketsful and the brick are usually wet for long periods after this season. The storage piles were situated just under the kilns, which are out in the open, except for the feed and discharge ends. The heat from the kilns is said to keep the brick in fairly good condition. It was noted, however, that brick which had been in storage for considerable time showed distinct signs of deteriorating. The brick were weak and easily broken, where a new brick of the same manufacture stood rough handling. The superintendent of the plant reported no apparent reduction in service on account of the outdoor storage. In a section of the country where the extremes of temperature are encountered each year these brick could not possibly be stored out of doors.—Ed.

"**Brick for Rotary Cement Kilns.**—While it might be supposed a basic brick would give the best results in cement kilns, according to W. Hamilton Patterson (British Iron and Steel Institute, Carnegie Scholarship Memoirs, Vol. 6, 1914) an exceedingly satisfactory brick was: SiO_2, 73.2%; Al_2O_3, 18.3%; Fe_2O_3, 6.5%; TiO_2, 0.4%; CaO, 0.4%; MgO, Tr.; alkalis, 0.50%; loss on ignition, 0.22%. The melting point was 1735°C. His explanation of the success of such a brick is that it fuses on the surface and forms with a cement clinker a protective coating. The question of protective coatings may thus be an important one in judging fire brick."—Donald M. Liddell, "The Metallurgists' and Chemists' Handbook," McGraw-Hill Co., N. Y.

"The chief characteristics of Suprafrax as affecting rotary kiln operation are:

High refractoriness (fusion point about 3400°F)
Adaptability for taking and holding a clinker coating
Resistance to chemical action of the clinker
Resistance to abrasion
High load-carrying capacity under high temperatures."

Control of Size and Uniformity

"A further item of importance as affecting the lining service as developed in this particular type of lining as compared to the ordinary fire-clay type is the greater control of size and uniformity possible. Uniform liner dimensions facilitate not only the ease of the mason's work but promote better brickwork and thin joints, the latter being the highly desirable feature in the kiln construction. Due to its greater refractoriness, it is also feasible to use a 6-in. liner in place of the ordinary 9-in., thus requiring a smaller amount of power to actuate the kiln and in addition increasing the kiln capacity.

"The desired properties of this material as adapted to cement kiln practice are dependent not only upon raw materials used but also upon the methods of fabrication and manufacture employed. The grinding, molding and burning procedures used in the manufacture of refractories have a distinct bearing upon the properties of the finished product.

"More specific mention may be made of the properties of this high aluminous liner."

Fusion Point

"The fusion point is given as Seger cone 37–38 or 3400°F, Seger scale; 3308°F, Bureau of Standards scale. This fusion point is, of course, far in excess of temperatures reached in rotary cement kilns giving an ample factor of safety in the heating control as well as making it possible to go to high temperatures during the coating process."

Constancy of Volume at High Temperatures

"When subjected to the standard reheat test of the A.S.T.M. (C 27–30) calling for a continued temperature of 2552°F, for 5 hrs.—no change to slight expansion is shown. With such a property the lining will remain tight and rigid."

Resistance to Load

"A contraction of less than 2% is shown when the refractory is subjected to a load of 25 lbs. per sq. in. at a temperature of 2462°F, for $1^1/_2$ hrs. according to specifications C 16–20 of the A.S.T.M. This load carrying-capacity guards against any undue shrinkage in the lining which might be caused either by the weight of the clinker or the pressure caused by any expansion tendency of the material itself."

Resistance to Abrasion

"The material itself is exceptionally tough and strong and resists great abuse without showing any appreciable wear, it having a modulus of rup-

ture of from 800 to 1000 lbs. and an end cold-crushing strength of about 3100 lbs. It is highly desirable that a hot zone liner have strong resistance to abrasion under high temperatures.

"The porosity of this refractory lining ranges from 33 to 38%, in comparison to the porosity of 15 to 30% on ordinary fire-clay type of liners, yet it shows high mechanical strength. This is due to the fact that the relatively high porosity results from the physical makeup to the presence of a great many interstitial pores, all of which are relatively small; thus the individual pores which go to make up the total porosity are in themselves very small when compared to the pore spaces of many types of liners which possess a smaller total porosity. It is into these finely divided pores that the cement seeps during the coating process and lays the foundation for the much desired protective layer itself.

"In this connection there is another outstanding reason for success with Suprafax in the cement industry. When mixed with varying percentages of cement clinker and tested for fusion it is the least affected when compared with the more ordinary types of fire-brick liners. The action of the coating process is then that the lining, through its finely divided pore spaces, allows the clinker to take hold like so many 'fingers' and yet does not allow these fingers to eat it away rapidly through chemical action. Suprafax takes the coating and it holds it."—L. C. Hewitt, LaClede-Christy Clay Products Company, in *Cement, Mill and Quarry*, April 20, 1924.

Special Note: High alumina brick have been eminently successful in rotary kilns used for dead-burning dolomite. In one instance substitution of a diaspore refractory of the following analysis, for magnesite kiln liners, reduced the maintenance cost to a negligible quantity, where previously the expense of lining replacement and interruption to kiln service had almost made the operation impossible from an economic standpoint. Representative analysis of the brick used is Al_2O_3, 82.52; SiO_2, 12.08; Fe_2O_3, 1.50; CaO, 0.11; MgO, 0.22; Alk., 0.54; TiO_2, 3.01.—Ed.

The question of storage of refractories has been brought to the attention of this department. What effect does dampness, or water have on brick if they are allowed to absorb and hold it for an indefinite time before use? (This query does not take in the matter of freezing. Everyone knows that a brick is badly damaged when frozen.)

Does water dissolve, or otherwise destroy, the bond clay in a refractory brick?

What is the effect on the service of the brick that has been soaked with water indefinitely?

If a brick stands for a time exposed to the weather, and becomes soaked with water, are there any gases present in the average consuming plant which permeate the atmosphere of the yards, which will be absorbed in the water-soaked brick and reduce its ability to stand service? What about sulphur fumes, flue gases, and flue dust?

Can a brick so permeated with water be successfully dried out before laying? After laying? (Most brick layers wet the brick before laying although very little water gets into the pores of the brick. Furnace operators say they start a furnace slowly to dry it out. Do they start it slowly enough?)

If you have any data on the above questions, jot it down and send it along. The

sales force and sales engineers of every fire-brick organization should be consulted on this question and information contributed may help to bring to the consumer the necessity of providing adequate dry storage for his refractories. It will help the fire-brick manufacturer for him to do this, and many complaints will be eliminated.

The consumer has plenty of data on this if he can be made to talk. Get hold of him and find out what he thinks.

C. S. Gantt, purchasing agent of the Baltimore Copper Smelting and Rolling Company, one of the country's foremost advocates of methods by which the consumer can get out of the brick all there is in it, recently contributed an article, "Essential Factors Which Increase Life of Refractories." [1] His article touches the handling and storage in a very complete manner, and he stresses the necessity of keeping refractories in dry storage and states that "exposure deteriorates bond and weakens structure."—Ed.

[1] *Ceram. Ind.*, October, 242–44(1924).

ACTIVITIES OF THE SOCIETY

SUMMER MEETING HELD IN LOS ANGELES

Seventy-two members and guests of the American Ceramic Society attended the one-day session held at the Biltmore Hotel, Los Angeles, California, October 6, 1924. The following program[1] was given at the morning and afternoon meetings and at seven o'clock a banquet was served.

Morning Session

1. Opening Address ..... Ross C. Purdy
   General Secretary, American Ceramic Society
2. Tableware on the Pacific Coast ..... W. G. Jackson
3. Artificial Sillimanite as a Refractory[2] ..... Hewitt Wilson
   University of Washington
4. Synthetic Sillimanite in Ceramic Bodies ..... T. S. Curtis
5. Overhead Transportation in a Clay Plant .....
   Eng. Dept., Los Angeles Pressed Brick Co.

Afternoon Session

6. Cast Iron Enamels (with microphotographs) ..... A. Malinovszky
7. Seger's Rules for Control of Glazes ..... Ross C. Purdy
8. Notes on Terra Cotta Body Shrinkage ..... P. G. Larkin and E. R. Curry
9. Notes on Development of Vitreous Slips for Terra Cotta .....
   H. E. Davis and J. S. Lathrop
10. Tunnel Kilns ..... E. W. Ekstrand
11. Construction of Kiln Crowns ..... John Sawyer

Evening

Banquet at Hotel Biltmore ..... 7:00 P.M.
Address by F. S. Laurence, Executive Secretary, National Terra Cotta Society
Entertainment Features:

Tuesday, Wednesday and Thursday, October 7, 8, and 9 were given over to plant visitations with the following itinerary.

Northern section under the chairmanship of Benjamin Cake, General Superintendent of the Los Angeles Pressed Brick Company. The following plants were visited:

Los Angeles Pressed Brick Co., Plant 1
Batchelder Wilson Company
Tropico Potteries, Inc.
Empire China Co.
Pacific Clay Products Co., Plant 4

The southern trip under the guidance of T. S. Curtis, President of the Vitrefrax Company, covered the plants of the

Washington Iron Works
Whiting Mead Pottery Co.
The Vitrefrax Co.
California Clay Products Co.
American Grinding Company
The Los Nietos Plant of Pacific Clay Products Co.

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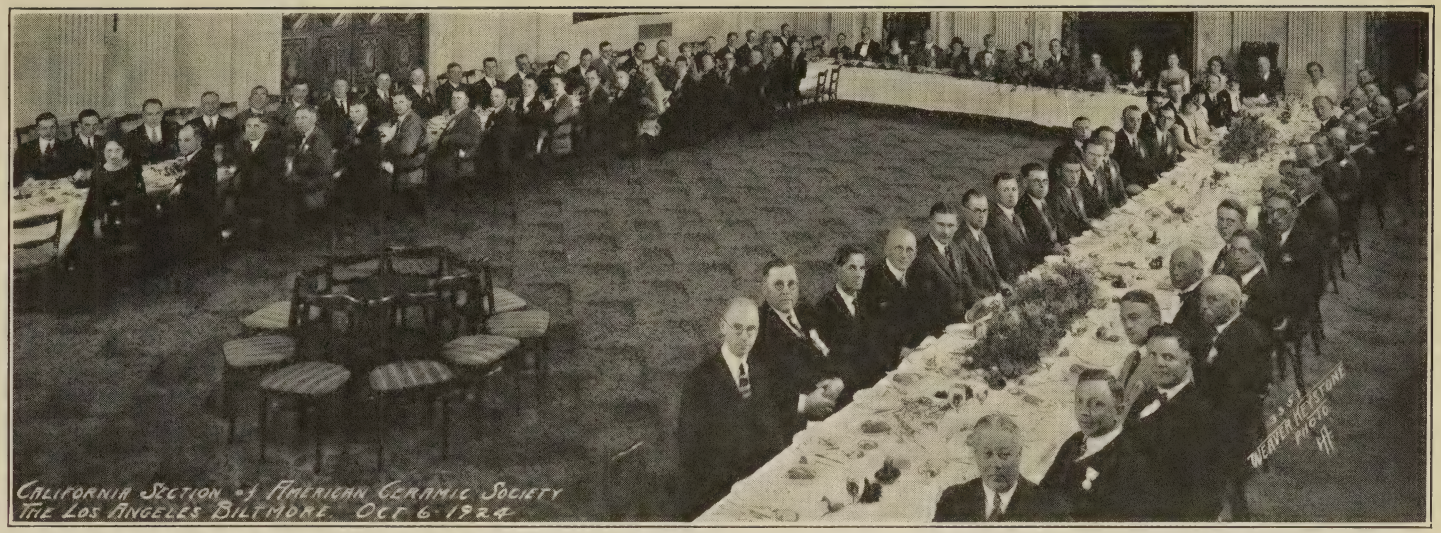
[1] These papers will be published in forthcoming issues of the *Journal*.

[2] Part I published in November *Journal*.

On Thursday an excursion was made to the deposits and plant of the Celite Products Company at Lompoc, California, under the guidance of C. A. Muketta.

The registration of attendance at the first day's session was as follows:

Name	Representing	Location
H. B. Potter	L. A. Pressed Brick Co.	Los Angeles
H. E. Davis	Tropico Potteries, Inc.	Glendale
S. Aronson	The Vitrefrax Co.	Vernon
J. L. Davies	Pacific Clay Prod., Inc.	Los Angeles
H. A. Huisken	The Vitrefrax Co.	Vernon
H. J. Knollman	The Vitrefrax Co.	Vernon
J. H. McKnight	Craycroft McKnight Co.	Fresno
F. L. Drinkwater	*Brick and Clay Record* *Ceramic Industry*	Los Angeles
Gregory L. Rogers		Los Angeles
John S. Lathrop	Tropico Potteries	Glendale
E. W. Ekstrand	Cons. Engineer	Los Angeles
T. A. Klinefelter	Gladding, McBean & Co.	Lincoln, Calif.
Geo. Brian	Paper Makers Importing Co.	Easton, Pa.
Finlay Drummond	The Vitrefrax Co.	Los Angeles
Karl Hart	The Vitrefrax Co.	Los Angeles
Rollin L. Lee	Abbé Engineering Co.	Los Angeles
B. C. Berg	Schurs Oil Burner Co.	Los Angeles
C. A. Muketta	Celite Products Co.	Los Angeles
L. F. Barber	Southwestern Eng Corp.	Los Angeles
Morgan D. Lalor	L. A. Pressed Brick Co.	Los Angeles
Edw. W. Koskinen	L. A. Pressed Brick Co.	Los Angeles
Elmer H. Ockerman	L. A. Pressed Brick Co.	Los Angeles
B. M. Burchfiel	Pacific Clay Prod., Inc.	Los Angeles
Frank C. Schultz	L. A. Pressed Brick Co.	Alberhill
J. L. Greenwood	L. A. Pressed Brick Co.	Alberhill
Robert C. Zehm	L. A. Pressed Brick Co.	Alberhill
Frank R. White	L. A. Pressed Brick Co.	Santa Monica
Fred O. Wanka	L. A. Pressed Brick Co.	Los Angeles
B. F. Cake	L. A. Pressed Brick Co.	Los Angeles
A. Malinovszky	Washington Iron Works	Los Angeles
Ross C. Purdy	American Ceramic Society	Columbus, Ohio
Fred B. Ortman	Tropico Potteries, Inc.	Glendale
T. S. Curtis	The Vitrefrax Co.	Los Angeles
P. J. McGuire	Kennard Eng. Co.	Los Angeles
W. E. Burke	American Trona Corp.	Trona, Calif.
D. C. Newmarch	L. A. Chamber of Commerce	Los Angeles
Edw. Reynolds	Santa Barbara Brick Co.	Santa Barbara
R. W. Ellison	The Vitrefrax Co.	Los Angeles
C. J. Phillips	N. Clark and Sons	Alameda, Calif.
G. D. Clark, Jr.	N. Clark and Sons	Alameda, Calif.
Paul G. Larkin	Gladding-McBean Corp.	Lincoln, Calif.
H. W. Weber	Russell Eng. Co.	St. Louis, Mo.
G. R. Boggs	Empire China Co.	Los Angeles
W. A. Potter	Pacific Sanitary Mfg. Co.	Richmond, Calif.
W. H. Hunt	Westinghouse High Voltage Insulator Co.	Oakland


CALIFORNIA SECTION of AMERICAN CERAMIC SOCIETY
THE LOS ANGELES BILTMORE. OCT 6 1924
WEAVER HEISTONE PHOTO

J. W. Moncrieff	Stockton Fire Brick Co.	Stockton, Calif.
V. R. Sullivan	Stockton Fire Brick Co.	Stockton, Calif.
C. Massey	Amer. Encaustic Tile Co.	Los Angeles
Thomas C. Walker	L. A. Pressed Brick Co.	Los Angeles
A. L. Gossman	Celite Products Co.	San Francisco
C. F. Moss	Celite Products Co.	Los Angeles
J. R. Allison	Celite Products Co.	Whittier
Gus Larson	L. A. Pressed Brick Co.	Los Angeles
G. J. Poxon	Poxon Pottery	Vernon, Calif.
C. E. Smoot	Smoot-Holman Co.	Inglewood, Calif.
H. H. Coors		Los Angeles
C. R. Minton	L. A. Pressed Brick Co.	Los Angeles
John Sawyer		Los Angeles
Arthur D. Storke	Kingman Feldspar Co.	Kingman, Ariz.
Raymond W. Ager	So. Calif. Edison Co.	Los Angeles
Chas. J. Biddle	Alberhill Coal & Clay Co.	Los Angeles
R. B. Keeler	Calif. Clay Prod. Co.	Los Angeles
Jno. F. Keenan		San Diego
F. Baddeley	Lincoln High School	Los Angeles
H. S. Kirk	Universal Sanitary Mfg. Co.	New Castle, Pa.
F. A. Moore		St. Louis, Mo.
F. H. Riddle	Champion Spark Plug Co.	Detroit, Mich.
Wm. G. Jackson, Jr.	Empire China Co.	Burbank, Calif.
W. L. Balderston	Pacific Scientific Co.	Los Angeles
Max C. Compton	L. A. Pressed Brick Co.	Los Angeles
H. W. Shepard	L. A. Chamber of Commerce	Los Angeles
F. S. Laurence	Amer. Terra Cotta Assoc.	New York, N. Y.

The Executive Committee for the meeting was composed of

F. B. Ortman.....Chairman
Finlay Drummond.....Treasurer
C. Berg.....Hotel Arrangements
H. E. Davis.....Program and Registration
T. S. Curtis.....Southern Trip
B. F. Cake.....Northern Trip
A. Malinovszky — Robert Linton
F. O. Wanka — Gus Larsen
Ray Boggs

NEW MEMBERS RECEIVED FROM SEPTEMBER 15 TO OCTOBER 15

PERSONAL

Boedicker, Earl O., 165 N. Portage Drive, Akron, Ohio, Sales Manager, Maurice A. Knight Co.

Cox, James, 6227 Reber Place, St. Louis, Mo., Engineer, Russell Engineering Company.

Dennison, Charles S., 1522 Malasia Road, Akron, Ohio, Superintendent, Maurice A. Knight Co.

Dowling, Guy E., 28 W. Atlantic St., Warren, Ohio, President, The Warren Engineering Co.

Fisk, Henry G., U. S. Bureau of Mines, Lord Hall, O. S. U., Columbua, Ohio.
Godard, Ray S., Box 40, Montreal, Canada, Works Manager, Consumers Glass Co., Ltd.
Goshorn, Robert R., Jr., Clay City, Ind., Indiana Brick & Tile Corp.
Hall, Edwin J., 212 N. 2nd St., Jeanette, Pa., Plant Chemist, American Window Glass Co., Factory No. 2.
Irish, William E., Erie City Iron Works, Erie, Pa., Works Engineer.
Jllgen, F., Bobrek O.-S. Julienhütte, Versuchsanstalt, Germany, Director of Research.
Luckie, John Barton, 509 Oliver Bldg., Pittsburgh, Pa., District Manager, Refractories Sales, E. J. Lavino & Co.
Maloney, Michal, 804 College Ave., Cleveland, Ohio.
Richardson, John W., Ingram-Richardson Mfg. Co., Frankfort, Ind., Superintendent.
Sherman, Ralph A., 4800 Forbes St., Pittsburgh, Pa., Assistant Physicist, Bureau of Mines.
Slagle, Edgar A., Box 88, Trenton, N. J., General Manager, Acree Colloidal Chemical Co.
Stewart, J. H., Box 258, Canton, Ohio, Assistant General Manager, The Stark Brick Co.
Westman, Albert E. R., Dept. of Ceramic Engineering, University of Illinois, Urbana, Ill., Research Associate.

CORPORATIONS

Federal Electric Company, 8700 S. State St., Chicago, Ill. Lee Hall, Representative.
The Westport Paving Brick Co., Westport, Baltimore, Md. John W. Hall, Representative.

Membership Workers' Record

	Personal	Corporation		Personal	Corporation
A. W. Buckingham	1		C. W. Parmelee	1	
Paul E. Cox	1		L. V. Reese	1	
J. W. Cruikshank	1		N. L. Schneider	1	
K. Endell	1		Leonard Sheerar	1	
Andrew Foltz	1		Office	4	1
Herbert Goodwin	1			—	–
M. A. Knight	2		Total	17	2
R. D. Landrum	1	1			

ANNOUNCE PROGRAM FOR ST. LOUIS SECTION[1]

The Executive Committee of the St. Louis Section, consisting of F. E. Bausch, *Chairman*, G. E. Thomas, C. W. Berry, and L. C. Hewitt, recently met to outline a plan of action for the coming Fall and Winter Sessions. Many good things are in prospect for the meetings. The coöperation and attendance of all the members is urged so that these meetings may be of utmost value to every one concerned.

The prospective program is:

October.—On October 28, the Section met jointly with the American Institute of Architects at the Architectural Club, Washington University, at which time matters of mutual interest to ceramists and architects were discussed. An exhibit of unusual interest was displayed.

November.—On November 25, it is planned to devote a special meeting to the subject of enamels. Every enamel man should be present. This meeting will also be of

[1] L. C. Hewitt, Secretary, St. Louis Section.

great interest to other than enamel producers as such subjects as enamel furnaces will be discussed and an exhibit of enameled products will be on hand.

January.—An outline of the rôle that Industrial Laboratories, such as Arthur D. Little, Inc., and Mellon Institute play in the development of the ceramic industry.

February.—The manufacture of plate glass, illustrated.

March.—Oil burning for ceramic kilns.

April.—The manufacture of lead pencils.

PITTSBURGH SECTION ELECTION[1]

At a meeting of the Pittsburgh Section of the American Ceramic Society held in the Mellon Institute on October 3, 1924, H. Foster Robertson was elected Secretary to take the place of Mr. Schurecht, who resigned on account of his having accepted a position with the Bureau of Standards in Washington. J. Spotts McDowell was elected as Vice Chairman.

The meeting discussed programs and the policy of the Society for local meetings.

MEETING ON OCTOBER 20

Members of the Pittsburgh Section of the Society held a meeting on October 20 at which time the following addresses were made: Walter Kennedy of the Celite Products Co. gave a paper on "Kiln Insulation;" W. K. Brownlee of the Buckeye Clay Pot Co., Toledo, Ohio gave an address on "The Effect of Insulation on Flux Line Blocks in Glass Melting Tanks."

PACIFIC NORTHWEST CLAYWORKERS' ASSOCIATION AND LOCAL SECTION OF THE AMERICAN CERAMIC SOCIETY[2]

The summer meeting of the Pacific Northwest Clayworkers' Association and Local Section of the American Ceramic Society was held in Spokane, Sept. 26 and 27. On the first day the visitors from Seattle, Portland, Yakima, Mead, Clayton, Auburn, Granger and Troy, Idaho were taken by auto to visit the kaolin, fire brick, face brick and sewer pipe clay pits and plants of the Washington Brick, Lime and Sewer Pipe Co., and the American Fire Brick Co.'s plants at Mica, Spear and Clayton.

Thirty attended the meeting at the Hotel Davenport the following day to discuss the subject of marketing clay products. F. T. Houlahan, chairman, presided. Victor Piollett, vice-president of the Washington Brick, Lime and Sewer Pipe Co., explained the difference between dealers' merchandising methods in the west and in the east, pointing out that in the west the manufacturers had to sell their own products with little or no aid from other agencies. A big selling point, he said, was to inject the human touch such as displaying the samples attractively and gaining the confidence and approval of architects and builders.

P. S. MacMichael, Northern Clay Co., Auburn, Washington, spoke on "Quality." He condemned price-fixing as harmful to the industry and to the public. He emphasized the need for all manufacturers to strive for quality in their products and for conducting business on a higher plane. "One of the best selling arguments," he said, "will come from the good words passed from mouth to mouth by satisfied users."

An address on "Service" was given by Bertram D. Dean, manager of the P. N. W. Brick Manufacturers' Association, Seattle.

[1] J. W. Cruikshank, Chairman.

[2] Hewitt Wilson, Secretary.

A. B. Fosseen, President of the Washington Brick, Lime and Sewer Pipe Co., declared manufacturers must help one another and praised the association and its purpose. He stated that there was no need to fight competitors but instead, show the public the superiority of the clay products. He stressed the importance of giving the consumer the best under all circumstances and asserted that the time was coming when the clay industry would be a more vital factor in the community.

Hewitt Wilson, University of Washington, spoke briefly on the necessity of intensive advertising and service to the small builder.

The afternoon session was followed by a banquet at the Hotel Davenport Saturday evening with Mr. Fosseen acting as toastmaster.

PACIFIC NORTHWEST SECTION MEETING

Twenty-five members of the Pacific Northwest Section of the American Ceramic Society met for a noon luncheon on Oct. 17, in the L. C. Smith Building Restaurant, Seattle, Wash., to hear Mr. Ross C. Purdy, General Secretary of the American Ceramic Society, talk on the development and work of the American Ceramic Society.

Mr. and Mrs. Purdy are touring the Pacific Northwest as they return from the recent ceramic meeting in Los Angeles. They have visited the ceramic plants in both Portland and Seattle, the Ceramic Engineering Department at the University of Washington, have taken the beautiful Columbia River Highway drive and have seen the beauties of the Seattle boulevards, lakes and Mt. Rainier.

Those present at the noon day luncheon were: Paul S. MacMichael, Northern Clay Co., A. L. Bennett, Northern Clay Co., F. T. Houlahan, C. L. Houlahan and Arthur Houlahan, Seattle Brick Tile and Delivery Co.; R. A. Swain, Sam Geijsbeek, H. B. MacMillan, Olaf Olsen, of the Denny Renton Clay and Coal Co., Hewitt Wilson, R. D. Reed, M. L. Brandenbury, Hobart Goodrich, M. C. Reynolds, J. R. Gednetz from the Ceramic Department, Univ. of Washington, W. E. Clark, Washington Brick Lime and Sewer Pipe Co., T. S. Lippy, Harper Brick and Tile Co., A. B. Storey, Bothell Brick and Tile Co., H. W. Beecher, Charles C. Moore Co., J. O. Hankins, Seattle Pottery Co., S. L. Glover, Landes and Glover, Geologists, C. E. Curtis, U. of W., George Stirrat, Seattle Brick and Tile Co.

Hewitt Wilson, *Secy.*

REPORT OF RENSSELAER CENTENNIAL

L. E. Barringer, who acted as representative for the American Ceramic Society at the Centennial Celebration at Rensselaer Polytechnic Institute, Troy, N. Y., October 3–4, has presented his official report of the meeting. Mr. Barringer states: "The Society is constantly becoming better known and that representation at such events is highly desirable in maintaining our place among scientific organizations."

Mr. Barringer was among the 227 delegates representing educational institutions and scientific organizations from all over the world.

Among the speakers on the general program were the following men representing educational institutions and technical societies.

Herbert C. Hoover, Secretary of Commerce of the United States
Frank P. Graves, President, University of the State of New York
Sir Charles L. Morgan, President, Institution of Civil Engineers of Great Britain
Henri Abraham, Past President, Society of Electrical Engineers of France
Luigi Luiggi, President, Society of Civil Engineers of Italy
Arthur Surveyer, President, Engineering Institute of Canada

Palmer C. Ricketts, President, Rensselaer Polytechnic Institute
Livingston Farrand, President, Cornell University
James R. Angell, President, Yale University
Edward A. Birge, President, University of Wisconsin
Samuel W. Stratton, President, Massachusetts Institute of Technology
Albert A. Michelson, President, National Academy of Sciences
Carl E. Grunsky, President, American Society of Civil Engineers
Frederick R. Low, President, American Society of Mechanical Engineers
William Kelly, President, American Institute of Mining and Metallurgical Engineers
Farley Osgood, President, American Institute of Electrical Engineers.

CHROME REFRACTORIES BIBLIOGRAPHY

L. J. Trostel, Chairman, Committee on Data, Refractories Division, has recently undertaken the compilation of a bibliography of articles dealing with chrome refractories. He has requested that any one keeping card index references on this subject communicate with him, so that a check may be made on the list which he has in hand.

Much interest is being shown in the bibliographies which are being issued by the Refractories Division. The Magnesite and Silica Bibliographies have been ditributed and the bibliography on Clay Refractories under the direction of R. F. Ferguson has been compiled in preparation for printing.

NOTES AND NEWS

FALL ACTIVITIES IN CERAMIC SCHOOLS

All Show Increase for 1924–25

In reply to a questionnaire recently sent out from the office of the Editor to the various Ceramic Departments of the Universities of this country, figures show that there is a widespread and increasing interest in educational growth in ceramics. Every one of the older schools reports an increase in number of students, a development of courses and additions to resources and equipment. Two schools are reporting students for the first time in their newly organized departments.

Alfred University leads in the number of Senior students, reporting 24, with 19 at Ohio State University and 15 at the University of Illinois.

The reports from the heads of the Ceramic Departments follow:

Ohio State University

	1923	1924
Post graduates	3	3
Seniors	6	19
Juniors	17	26
Sophomores	28	34
Freshmen[1]	14	17
	68	99

[1] Freshmen do not register in any particular department but may indicate their intention. Hence the Freshmen register is never complete.

The Senior class consists of:

Ammon, M. G.	Grady, G. M.	Simpson, H. E.
Arnold, T. M.	Lepper, A. E.	Stull, Francis
Austin, J. S.	Lower, D. E.	Westendick, F. C.
Bozman, W. D.	Mayfield, C. C.	Burkhalter, Edward
Doll, C. E.	Porter, P. W.	Clawson, C. D.
Franz, L. J.	Senn, W. E.	Merrett, C. W.
Gould, Robert		

Prof. C. B. Harrop having resigned, it was necessary to obtain a teacher for Ceramic Engineering, Design and Construction, and Prof. R. C. Sloane of the Civil Engineering Department was secured for one year at the end of which a permanent appointment will be made.—By A. S. Watts, Professor, Dept. Ceramic Engineering.

University of Illinois

	1923	1924
Freshmen	27	28
Sophomores	15	26
Juniors	18	20
Seniors	18	15
Special	1	
Graduate Students	6	6
Total	85	95

List of Senior students:

Abney, Charles L.	Grigsby, Chester E.	Levystein, Alan
Bopp, Harold F.	Grout, Jack R.	McNair, Francis G.
Bradley, Richard S.	Halloin, William G.	Parmelee, Cullen E.
Fels, Clarence G.	Innes, David H.	Schoreder, Geo. C.
Foster, Edwin S.	Lampe, Chester E.	Whitney, Wm. Percy

New Instructors

Dr. A. E. R. Westman, a graduate of the University of Toronto has been appointed Research Associate. W. H. Pfeiffer, E. P. Wright and A. J. Paul have been appointed to assist in the research program on refractories and porcelain. Six Public Utilities companies in the northern part of Illinois have provided funds for research on electrical porcelain and refractories. The total amount which has been provided is $12,500 each year for two years.

The Titanium Alloys Manufacturing Company of New York has provided funds for research on metal enamels. This investigation as planned is to be conducted during the next two years.—By Cullen W. Parmelee, Professor and Head of Department.

The New York State School of Clay-Working and Ceramics at Alfred University

	1923–24	1924–25
Seniors	22	24
Juniors	27	19
Sophomores	22	31
Freshmen	37	46
Specials	3	9
Total	111	129

Senior Students, 1924-25

Engineering	Applied art
Orray T. Fraser	Elizabeth Burdick
George H. Garnhart	Gertrude R. Burgess
Stoneson Grant	Eleanor E. Craig
Leslie F. McConnell	Clarice C. Davis
Henry E. Marley	Ada R. Mills
David W. Miller	Hazel M. Niver
Remington M. Murphy	Margaret L. Prentice
Marvin H. Pond	Ruth D. Whitford
Harold M. Rice	Mary Alma Wise
Harold T. Rogers	
Frederick M. Strate	
Stephen M. Swain	
We Wei Tsou	
Herman Tuckman	

Dr. A. I. Andrews has been appointed Professor of Ceramic Engineering and Neal C. Welch has been made laboratory assistant. The new courses offered include Ceramic Geology and Mineralogy and Power and Machinery.—By C. F. Binns, Director,

Iowa State University

The total enrollment for 1924–25 is 31, an increase of 9 over 1923–24. There are 9 Freshmen enrolled, and 3 Seniors, one completing the course at the end of the Winter Quarter. Among the students is one from British India and one from the Philippines.

Additional space has been added to the Department, doubling the space occupied last year.

Miss Mary Lanier Yancey, of the H. Sophie Newcomb Memorial College, Tulane University, New Orleans, has been added to the Department to handle the work in art pottery.—By Paul E. Cox, Dept. of Ceramic Engineering.

University of Washington

There are 7 students this year, with one, M. E. Reynolds, a senior. Three were graduated last year: H. C. Fisher, now with Norton Co., Worcester, Mass., Wallace Thoreseon, Washington Brick, Lime and Sewer Pipe Co., Spokane, and Hilding Johnson, Denny Renton Clay and Coal Co., Seattle.—By Hewitt Wilson, Ceramic Engineering.

Pennsylvania State College

First registration: Freshmen 2, Sophomores 4, Juniors 1.—By J. B. Shaw, Professor of Ceramic Engineering.

Georgia School of Technology

First registration limited to Sophomore students this year with 4 enrolled. The building is nearing final stages of completion and will be occupied at once.—By A. V. Henry, Dept. of Ceramics.

DR. GRANGER ELECTED TO CHAIR OF CERAMICS

M. Albert Granger, Docteur Ès-Sciences, of La Manufacture Nationale de Sèvres, writes under date of September 22 that he has been elected to the Chair of Ceramics in Le Conservatoire National des Arts et Metiers. Dr. Granger states that he will

have his laboratory as formerly at the factory at Sèvres. The work at the Conservatoire will have to do with ceramic materials, cements and mortars. Dr. Granger has always been ambitious to add to his activities as an educator and this new position expands opportunity in that field for him, not forgetting the added work he will be able to do in research fields. He states that many improvements have been made in the always adequate laboratories at Sèvres.

NECROLOGY

Announcement has been received of the death of William G. Stevenson, on August 21, 1924. Mr. Stevenson was general manager and treasurer of the National Silica Co., Oregon, Illinois. Mr. Stevenson had been a member of the American Ceramic Society since 1906.

LENOX, INC., ISSUES FREE FILM

Lenox, Inc., Trenton, N. J., announces a free moving picture film for educational purposes, showing every process in making Lenox China. This film was issued on October 1, 1924. Museums, schools, women's clubs, etc., interested in obtaining this film should communicate with J. Alexander Leggett, 1476 Broadway, New York City.

BROADCASTING TALKS ON CHEMISTRY BY RADIO

Six talks on "The Rôle of Chemistry in Every-Day Life" will be broadcast from the University of Pittsburgh radio studio of KDKA, of the Westinghouse Electric and Manufacturing Company, of East Pittsburgh, Pa., according to an announcement from the University. These talks, which have been especially prepared by members of the University's Department of Chemistry, are scheduled for 8:15 P.M. each Wednesday evening, as follows:

October 8, "The Place of Chemistry in Every-day Life," by Alexander Silverman, M.S., head of the Department of Chemistry.

October 15, "The Air We Breathe and the Water We Drink," by Kendall S. Tesh, Ph.D., instructor in inorganic chemistry.

October 22, "The Food We Eat," by Charles G. King, Ph.D., professor of sanitary chemistry.

October 29, "Coal: A Factor in Industry and Health," by Alexander Lowy, Ph.D., professor of organic chemistry.

November 5, "Heat and Cold: What They Mean to Us," by Gebhard Stegeman, professor of physical chemistry.

November 12, "Glass: One of Man's Blessings," by Alexander Silverman.

Syllabi containing outlines of the lectures, reading references, and questions for the purpose of supplementary study have been printed and are available at a cost of twenty cents. These may be obtained by addressing The Radio Manager, University of Pittsburgh, Pittsburgh, Pa.

CORRECTION TO LIST OF GEOLOGISTS

The following corrections have been issued for the "List of State Geologists"[1] issued recently.

Arkansas. Geo. C. Branner, State Geol., Fayetteville, Ark.

[1] *Bull. Amer. Ceram. Soc.*, **3** [7], 267(1924).

California. Lloyd L. Root, Ferry Bldg., San Francisco, Calif.
Idaho. Idaho Bur. Mines and Geol., Dean Francis A. Thomson, Moscow, Idaho.
North Dakota. Prof. A. C. Leonard, State Geol., Grand Forks, N. D.
New Jersey. H. B. Kümmel, State Geol., Trenton, N. J.
Minnesota. Dr. W. H. Emmons, University of Minn., Minneapolis, Minn.
Oregon. I. A. Williams, Director, Hood River, Oregon.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Assn. Adv. of Science	Dec. 29, 1924–Jan. 3, 1925	Washington, D. C.
Am. Assn. of Flint and Lime Glass Mfrs. (Annual Meeting)	July, 1925	Atlantic City, N. J.
Am. Concrete Institute	Feb. 24–27, 1925	Chicago, Ill.
Am. Face Brick Assn.	Dec. 2–4, 1924	Hot Springs, Va.
The American Institute	Dec., 1924	New York City
Am. Inst. of Chemical Engrs.	Dec. 3–6, 1924	Pittsburgh, Pa.
Am. Society of Mech. Engrs.	Dec. 1–4, 1924	New York City
Common Brick Mfrs. Assn.	Feb. 9–13, 1925	Chicago, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Exposition of Inventions	Dec. 8–13, 1924	New York City
Hollow Bldg. Tile Assn.	Jan., 1925	Chicago, Ill.
Manufacturing Chemists' Assn.	June, 1925	New York City
Mining & Met. Society of America	Jan. 13, 1925	New York City
Natl. Academy of Sciences	Nov. 10–12, 1924	Cambridge, Mass.
Natl. Assn. of Mfrs.	May, 1925	New York City
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	March, 1925	Pittsburgh, Pa.
Natl. Assn. of Stove Mfrs.	May 13–14, 1925	New York City
Natl. Clay Products Industries Assn.	April, 1925	Chicago, Ill.
Natl. Exposition of Power & Mech. Engrs.	Dec. 1–6, 1924	New York City
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
National Lime Association	May, 1925 (?)	
N. J. Clayworkers' Assn. and E. Sect. of the American Ceramic Society	Dec., 1924	New Brunswick, N. J.
Taylor Society	Dec. 4–6, 1924	New York City
Tenth Exposition of Chem. Industries	Sept. 28–Oct. 3, 1925	New York City
Tile & Mantel Contractors' Assn. of America	Feb. 9, 1925	Louisville, Ky.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)
Western Paving Brick Mfrs. Assn.	Jan., 1925	Kansas City, Mo.

BULLETIN
of the
American Ceramic Society

A Monthly Publication Devoted to Proceedings of the Society, Discussions of Plant Problems, Discussions of Technical, Scientific and Art Questions and Promotion of Coöperative Research

Edited by the Secretary of the Society Assisted by Officers of the Industrial Divisions

Mary G. Sheerer, H. S. Kirk — Art
R. R. Danielson, H. G. Wolfram — Enamel
G. E. Barton, A. N. Finn — Glass
F. A. Harvey, R. F. Ferguson — Refractories
F. H. Riddle, C. C. Treischel — White Wares
W. D. Gates, B. S. Radcliffe — Terra Cotta
F. T. Owens, A. P. Potts — Heavy Clay Products

OFFICERS OF THE SOCIETY

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Vitreous Enameling Co., Cleveland, Ohio
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1538 N. High St., Columbus, O.
Ross C. Purdy, General Secretary
Helen Rowland Fox, Assistant Secretary
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C. C. Treischel

Vol. 3 — December, 1924 — No. 12

EDITORIAL

THIRTY YEARS OF COÖPERATIVE CERAMICS

From prehistoric times ceramic wares have been essential to man's welfare. He builded his abodes, fashioned his utensils, expressed his art and recorded his achievements in clay and glass. With civilization, ceramics advanced and retarded. With changes in local ideals and customs ceramics changed, but the art of ceramics and ceramics as the medium of art expression was at no time lost to the world; each advance was permanent. Utility and art were never divorced. With the discovery that clay could be fashioned and its form made permanent by firing, clay vessels were home utensils and home utensils were home decorations. Glass may have been formed first by chance but it was not by chance that the history of glass-making parallels the history of art and civilization. Ceramic wares have in all ages been essential to man's material and spiritual welfare, but their production was by individuals, each building into his ware his own art inspirations.

Until very recently man was almost wholly individualistic; each was for self. Survival of the fittest was the motivating slogan; coöperation was unknown.

Coöperation became more and more essential as man emerged from serfdom and slavery, and as he produced more and more of what he did not himself consume. Individualism has grown apace with collectivism for no man

can shift onto others his responsibility for self-expression and self-attainments, but man can no longer advance self either at the expense of his fellows, or without his fellows' aid. The complexity of and democracy in human affairs makes it advantageous for men to coöperate. No one in these days has the time and the ability to accomplish or to comprehend all phases of the affairs with which he must now be concerned. This has led to specialization in effort and to coöperation. Coöperation is more selfish than it is altruistic. Coöperation is absolutely essential to an individual's industrial welfare. Coöperation emphasizes individualism, for by coöperation the resources of each individual are manifolded.

As industrial ceramics developed there has been more and more dependence on the coöperation of specialists. No persons working alone could make and market any other than the simplest ware on the smallest possible production basis. Modern production is now on a tonnage basis but with no less demand for quality and art.

Within the last few decades industrial ceramics has developed the demand for specialists who can translate ceramic problems into terms of the fundamental sciences and can keep ceramic science apace with the rapidly growing wealth of scientific facts. This demand brought into existence the modern ceramic schools.

Only thirty years have passed since the world's first collegiate department of ceramic engineering was established. The organizing of the American Ceramic Society was the next expression of the industrial demand for coöperative development of individuals. Specialists are essentials in the present industrial scheme of affairs, but specialists without an organized means of coöperation would retard rather than progress industrial development.

Coöperation in ceramics is not the carping of an idealist nor the dream words of the altruist; it is the fact realization of those who have builded wisely and largely. It pays individuals to work in the ways provided by the American Ceramic Society.

PAPERS AND DISCUSSIONS

REFRACTORIES QUESTION BOX

E. E. Ayars, Editor

Question

What simple laboratory tests can be used to keep the quality of refractories up to standard?

Discussion

The simplest test which can be used in a fire-brick plant to maintain the quality of the product is a reheating of the brick to a high temperature. The equipment is simple and easy to operate. A furnace having a combustion chamber about 18 inches each way can be built from brick which are at hand. Kerosene or fuel oil can be used, and a low-pressure burner, preheating coil, and a small blower and motor is all the equipment which it is necessary to purchase. Two hundred dollars should cover the complete investment.

The test consists in placing the brick on end in the furnace and running the heat for five or six hours. Cone 18 is sufficiently high to give an indication of the quality of many brick, but such a furnace should be capable of attaining cone 26.

With most clays, iron is the insidious enemy, and any marked increase in iron content will be quickly shown by the spots developed in the test. A decrease in the refractoriness of the bond clay will be shown by excessive vitrification or by overfiring. An abnormally coarse grind will cause the brick to squat prematurely, and an abnormally fine grind will be shown by early vitrification. Underfired brick will shrink excessively, and inferior clay will swell. Sandy clay will cause the brick to crack.

This reheating is preferable to a fusion test because it is easier to make in the average plant and requires less equipment. Furthermore, it will give more information. A fusion test should also be run at intervals, both on the clay and the brick, but most plants will find that this can be done more cheaply and more accurately at a properly equipped testing laboratory than at the plant. A reheating to cone 20 of brick from different sources, will usually leave no doubt as to which is the superior refractory."—Robert F. Ferguson, Garfield Fire Clay Company.

Question

Will the use of "super-refractories" in boiler furnace work become general?

Discussion

My position on the matter of boiler refractories may be briefly summed

up as follows:[1] While there will undoubtedly be a limited demand for the so-called super-refractories which some of the manufacturers are producing at this time (in other words, refractories capable of withstanding upwards of 3500°F) the prices at which such material is offered make its use prohibitive in ordinary boiler construction and it is up to the user of fire brick to so construct his furnaces that the ordinary first grade refractories will function in a satisfactory manner. The results of this extensive investigation which I have made among large users of fire brick indicate that refractories rarely fail directly from fusion, the main cause of failure being the action of molten slag on the walls which enters the spaces between brick and the pores of the brick itself, causing the refractory particles to form a eutectic with the slag and flow away. This difficulty is very largely accentuated by the fact that the fire brick ordinarily furnished vary in dimensions through considerable limits, making necessary the use in some cases of comparatively large joints; and it is the feeling of the users that the greatest opportunity for improving the quality and increasing the life of commercial refractories lies in greater uniformity of dimensions. This point cannot be too strongly emphasized and it is a matter which has been repeatedly brought to the attention of the manufacturers so far with little in the way of definite results, and I would urge upon your SOCIETY the importance of impressing upon the manufacturers to so regulate their processes of manufacture that the fire brick to be used in furnace linings will have sufficient uniformity in dimensions to permit their being laid up with the use of a minimum of bonding material between courses.

Question

What do you find in the Question Box which has caused you to read to this point? If you have found anything of value during the past few months, it is highly probable that you can contribute questions and discussions that will be interesting to the other readers. Won't you sit down and frame your questions and discuss them. The Editor does not believe that his situation carries with it the duty of writing many discussions of such questions as are put, but rather the selection and compilation of discussions forwarded to him by the readers. Some readers have been very good about making contributions, but we need other viewpoints and experience, and various methods of expression. Address the Editor, care of the General Secretary.

[1] The following extract from personal correspondence was written by an engineer of several years' experience in power plant refractory problems, and at present working with no less than three national associations on the problem of proper boiler furnace refractories.

ACTIVITIES OF THE SOCIETY

NEW MEMBERS RECEIVED FROM OCTOBER 15 TO NOVEMBER 15

PERSONAL

Anwyl, Robert H., 215–15th Ave., Columbus, Ohio. Student.

Crandall, J. Ralph, 118–14th Ave., Columbus, Ohio. Student.

Eberle, William S., Box 25, Williamstown, W. Va. Secretary and Treasurer, The American Bisque Co.

Hall, John W., 3rd, 2124 Mt. Royal Terrace, Baltimore, Md. Westport Paving Brick Co.

Hayward, Claude C., 6186 Westminister Place, St. Louis, Mo. General Refractories Co.

Johnson, Gustaf A., 612 W. Main St., Maryville, Tenn. Technical Staff, Aluminum Co. of America., Alcoa, Tenn.

Kirk, Brenton S., New Philadelphia, Ohio. Superintendent, The Belmont Stamping & Enameling Co.

Lower, Donald E., 1942 Iuka Ave., Columbus, Ohio. Student.

Morgan, James W., Jackson, Ohio. Secretary-Treasurer, The Morgan Horton Clay Co., Eifort, Ohio.

Smith, Kenneth M., 213 N. 11th St., Cambridge, Ohio. Ceramic Engineer, Cambridge Sanitary Mfg. Co.

Yancey, Mary L., 304 Russell Ave., Ames, Iowa. Instructor in decorative pottery at Iowa State College.

CORPORATION

Hartford-Empire Company, Box 1411, Hartford, Conn. F. Goodwin Smith, Vice-President.

Stettiner Chamottefabrik Akt.-Ges. vorm. Didier, Stettin, Schwarzer Damm 1 u. 13 a., Germany.

Membership Workers' Record

	Personal	Corporation
George A. Balz		1
Paul F. Cox	1	
J. C. Hostetter		1
R. K. Hursh	1	
F. G. Jackson	1	
L. W. Manion	1	
Office	7	
Total	11	2

MEETING OF PORTLAND CERAMISTS

On Friday evening, October 16, two dozen Portland, Oregon clayworkers and friends assembled at an informal dinner in the Multnomah Hotel, one of Portland's leading hostelries. This gathering was complimentary to Mr. and Mrs. Ross C. Purdy of Columbus, Ohio, at the end of their two-days' visit to this most attractive and thriving seaport of the Pacific Northwest.

Secretary and Mrs. Purdy were on their return trip to Columbus from attendance at the Summer Meeting of the American Ceramic Society in Los Angeles, October 6 and 7. Wednesday and Thursday, October 15 and 16, were spent in Portland. The first of the two days was devoted entirely to seeing the city and to an automobile ride of a little less than one hundred miles over one of the most scenic portions of the celebrated Columbia River Highway. This highway is a paved boulevard for close to two hundred miles through the depths of the canyon of the Columbia River. The party was piloted on this day by Raymond R. Smith, of the Denny-Renton Clay and Coal Company, M. L. Bryan, of Columbia Terra Cotta Company and Ira A. Williams, Consulting Geologist, all former acquaintances of Mr. and Mrs. Purdy.

The second day, Thursday, October 16, was given to plant visitations in and about Portland. Among the factories visited were Standard Brick and Tile Company, through the courtesy of A. H. Wethey, Jr., President; Pacific Stoneware Co., T. S. Mann, President; Sewer-pipe Plant of Denny-Renton Clay and Coal Co., enameling department of the Portland Stove Works, and the plant of the Columbia Terra Cotta Company in Vancouver, Washington, owned and operated by M. L. Bryan.

Ira A. Williams, who has long been identified with the ceramic industries in both middle and western states, presided at the get-together dinner in the evening at the Multnomah Hotel. Mr. Purdy, in his customary apt and entertaining way, told of the growth and activities of the American Ceramic Society, and spoke of the needs of the industries which it represents. The desirability of conducting technical research along various ceramic lines was emphasized, and attention called to the importance and necessity of every one contributing freely of their own experience in the advancement of the business of the individual and of the ceramic industries as a whole.

The following persons were present at the dinner, eight of whom are members of the American Ceramic Society:

Mr. and Mrs. Ross C. Purdy, Columbus, Ohio
H. C. Elliott, Cascade China Company, Portland
Mr. and Mrs. M. L. Bryan, Columbia Terra Cotta Company, Vancouver, Wash.
Mr. and Mrs. T. S. Mann, Pacific Stoneware Company, Portland
Mr. and Mrs. A. H. Wethey, Jr., Standard Brick and Tile Company, Portland
F. J. Pohs, Portland Stove Works, Portland
Mr. and Mrs. H. R. Kreitzer, Columbia Brick Works, Portland
Mr. and Mrs. O. K. Edwards, Face Brick and Tile Mfr., Portland
Mr. and Mrs. J. E. Walling, Denny-Renton Clay and Coal Company, Portland
W. Foster Hidden, Common Brick Mfr., Vancouver, Wash.
Mr. and Mrs. L. A. Martin, Columbia Terra Cotta Company, Vancouver, Wash.,
L. E. Kern, Kern Clay Products Company, Portland
J. F. Straumford, Denny-Renton Clay and Coal Company, Portland
Miss Ersel Foron, Campbell Hill Hotel, Portland
Ira A. Williams, Consulting Geologist, Portland

MEETING OF ST. LOUIS SECTION[1]

A joint meeting of the St. Louis chapter of the American Institute of Architects, and the St. Louis Section of the American Ceramic Society was held at Washington University, Tuesday evening, October 28.

As usual, this was a dinner meeting and was held in the dining room at Washington University. The attendance of both Societies was evenly divided. The meeting was

[1] By F. E. Bausch, Chairman.

exceedingly interesting and enthusiastic. Wm. A. Hirsch, President of the St. Louis Chapter of American Institute of Architects presided and the various speakers of the evening were introduced by F. E. Bausch, Chairman of the St. Louis Section of the SOCIETY. Preceding the meeting, there was an inspection of an exhibition of polychrome and pulsichrome terra cotta by the two local terra cotta companies, namely, the St. Louis Terra Cotta Co., and the Winkel Terra Cotta Co.

W. T. Doyle, manager of the Terra Cotta Service Bureau of Chicago, made an excellent talk on the purpose of the Terra Cotta Service Bureau and its efforts in behalf of standardization of the work; also the promotion of a better understanding between the manufacturer and the user of terra cotta. An interesting discussion followed on this paper by some of the best known local architects, namely, Messrs. Mauran of Mauran, Russell, Crowell; Mr. LaBeaume and J. P. Jamieson, of the firm of architects who designed the buildings comprising the Washington University group. C. E. Klipstein who was on the program was not able to appear.

Prof. G. Ferrand, School of Architecture, made a very interesting talk on the splendid facilities and equipment of Washington University in connection with a contemplated course in ceramics, inasmuch as the University has an exceptionally good chemistry department and a new building is just being erected for a geology department. The laboratory is well-equipped with machines for testing materials.

There are various industries established in St. Louis where also the raw materials are secured which would enable ceramic students to come into intimate contact with the commercial product.

November Meeting of St. Louis Section

The members of the St. Louis Section of the SOCIETY held their November meeting on the evening of November 25. A dinner was served preceding the meeting which was held at the American Annex Hotel. Among the papers was, "Something New in Enameling—Grained Mahogany" presented by E. Eizenbrot of the Buck Stove and Range Co., who displayed specimens of his work as illustrations. F. G. Jaeger, President of the Superior Enamel Products Company, talked on "How Porcelain Enamel Signs Are Made."

NOTES AND NEWS

PRESIDENT LANDRUM HONORED AT DINNER

On Monday night, November 3, R. A. Weaver, Editor of *The Enamelist* and President of the Ferro Enamel Supply Company, gave a dinner at the University Club of Cleveland, in honor of R. D. Landrum, Vice-President of the Vitreous Enameling Company of Cleveland and also President of the AMERICAN CERAMIC SOCIETY.

Everyone thoroughly enjoyed the dinner after which Mr. Landrum made a few remarks regarding the past and future of the enameling industry and pointed out that every year new fields were being opened to the enameling trade.

He pointed out that when he first entered the business as a chemist for the Lisk Manufacturing Company that the only field open at that time was the kitchenware field with some little business in the bathtub industry. Since then all kitchens have been completely enameled with such items as gas ranges, coal ranges, refrigerators, table tops; kitchen cabinets being largely finished in porcelain. Bathrooms are completely finished in porcelain and the next step is to use porcelain to a large degree in basements. This is

being done by such concerns as the American Radiator Company who are advertising very largely the idea of having heating equipment housed in porcelain.

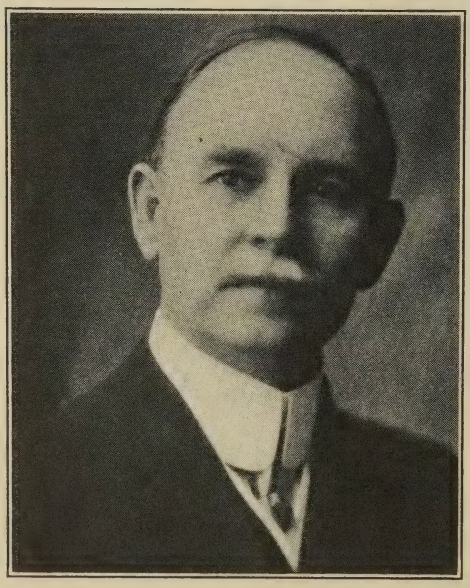
The following men who are interested in enameling were present at the dinner: R. D. Landrum and John Grainer from Vitreous Enameling Company, H. D. Cushman, J. D. Henry, H. C. Luebbert and R. L. Williams of the Ferro Enameling Company, Carl W. Mehling of The American Radiator Company of Buffalo, Paul Francais of The National Division of the American Stove Company, L. W. Manion of Canton, E. B. Prentice and H. F. Chrisman of The Massillon Refractories Company of Massillon, C. A. Blackburn and H. E. Barker of The Cleveland Metal Products Company, R. A. Weaver, H. E. Ebright, Paul Quay, H. L. Brooks, E. L. Stine, A. T. Davis, J. E. Rumer, Major Wilfred Mavor and R. A. Nelson of The Ferro Enamel Supply Company, H. E. Johnson of The Cincinnati Enameling Company, F. P. Allen of The Enamel Products Company, W. H. Wilson of The Lewis-Shepard Company, S. M. Jenkins of The Celite Products Company, F. G. Thorpe of The Brown Instrument Company, H. M. Richards of The American Rolling Mill Company and J. C. DeVol of The A. B. Stove Company.

After the dinner the entire crowd was entertained at the theatre, as guests of Mr. Weaver.

DEDICATION OF NEW CERAMICS BUILDING

Georgia School of Technology in Formal Opening

The first ceramic building south of the Ohio river was officially opened at Georgia Tech on Saturday morning, Nov. 15, when Prof. Watts, head of the ceramics department of Ohio State University, made his address on "Ceramic Resources in Georgia."



Dr. M. L. Brittain, Pres.
Formerly Supt. of Education of Ga. and Supt. of Public Schools of Atlanta.

The address was the outstanding feature of the exercises, followed by a luncheon given by M. L. Brittain to fifty prominent ceramic engineers of the south.

In addition to the ceramic experts of the south, many prominent educators were present. Among them was Chancellor Kirkland, of Vanderbilt University.

Course at Georgia Tech.

Ceramic instruction at Georgia Tech. was accomplished through support given the institution by the Atlanta Chamber of Commerce and Fulton County. Last year, under the leadership of George Carswell, President of the Senate, the Georgia legislature gave the school an annual maintenance fund of $10,000.

Courses of instruction at Georgia Tech cover a period of four years and lead to the degree of bachelor of science in ceramic engineering. A graduate of the department, according to A. V. Henry, in charge of the work at Tech must possess the basic knowledge which would enable him to prospect for raw materials and to carry them through the process of manufacture to the finished product.

The ceramics building is a one-and-a-half-story structure, 50 feet wide and 83 feet long, and is constructed of brick and terra cotta. It contains an office, library, classroom, testing laboratory, clay machinery room and kiln room.

Equipment of School

The testing laboratory is provided with balances, ball mills, molds, electric drier, electric oxidation furnace, a modulus of rupture testing machine and complete microscopic equipment.

In the clay machinery room may be found an emery wheel, jaw crusher, dry pan, pulverizer, rolls, auger machine, turning lathe, potter's wheel, jigger and complete

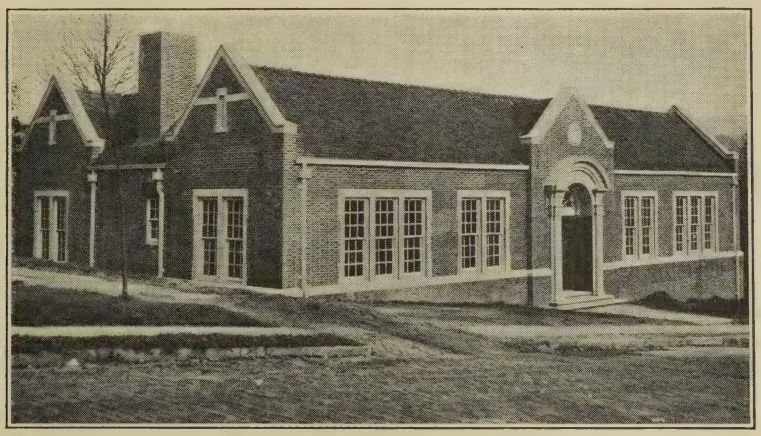


Fig. 2.—New Ceramics Building.

semi-commercial clay washer. The kiln room equipment consists of two experimental gas-fired kilns using induced draft, a pot furnace, a small muffle test furnace, a gas-fired drier, potentiometers and recording pyrometer.

Completion of the new building by the state of Georgia will enable students to combine the theoretical and practical aspects of ceramic engineering. Georgia contains vast beds of ceramic materials, including clays, kaolins, bauxites, feldspars, sands, cement rock and fullers' earth, and special inspection trips have been arranged by the department for juniors and seniors.

A. F. Greaves-Walker, head of the department of ceramic engineering, North Carolina State College, represented the American Ceramic Society at this meeting.

ADDRESS BY A. S. WATTS, AT DEDICATION OF NEW CERAMICS DEPARTMENT BUILDING

Prof. Watts in part said that a fair return on the investment may rightfully be expected from this school. A department of ceramics is especially unfortunate or fortu-

nate, according to viewpoint, because it has so many fields in which its service may be helpful. According to the various viewpoints it must solve ceramic problems, improve processes, lower cost of production, find new materials, improve products and train men to be superintendents and managers. It would be false to expect in a four-year course of instruction, to train men to be accomplished in all these things. The school must furnish the training as best it can and pass the men to the industries for completion of their education.

Before a young man can become useful industrially he must acquire industrial vision through direct contact with industry. He who accepts a position of responsibility without this vision and with only a theoretical education is courting disappointment.

Ceramic industries need men who can apply science fundamentals to problems of plant control and production.

The greatest drawbacks to progress in the ceramic industries are tradition and misunderstanding. The solution is coöperation between the schools and the manufacturers in providing for and requiring plant experience in the summer periods while the ceramic student is in school.

The ceramic resources of Georgia are many and varied: surface clays for common brick, hollow block, drain tile and sewer pipe; white clays and fluxing materials for face brick; and refractory clays for refractories. The white brick may be salt glazed. Terra cotta and sanitary ware may be made here and also glass. Pottery and faience tile are possible here. All of these require development of the sort in which a department of ceramics may be helpful. It requires more than raw materials. It must have proper buildings, equipment, processing, factory control and trained artisans.

The ceramic school will train men to explore the ceramic material resources of the state, to determine the methods and mixtures. They will be trained in ceramic processing. But this school should not attempt the training of artisans. Technical schools should not be made into trade schools nor trade schools into technical schools.

Manufacturers should establish fellowships here for the conducting of researches under the joint direction of the instructors and the manufacturers. Under such arrangements the student would receive a salary of about three hundred dollars from the manufacturer. This has served to (1) increase information; (2) give the student valuable industrial contact; (3) enable him to complete his education on money earned; and (4) enable the employer to determine the availability of the student for usefulness in his organization.

In closing Prof. Watts outlined ten specific endeavors the doing of even a few of which he averred would amply repay the investment here begun.

REPORT OF PROF. GREAVES-WALKER ON GEORGIA TECH DEDICATION

There were only fifty invitations issued and practically every one was accepted. The guests consisted principally of the clayworkers of Georgia and others interested in ceramics in the state who had made donations of money and materials that made the building possible. North Carolina State, Alabama Poly and University of Alabama were the colleges represented.

Due to the funeral of Dean Emerson of Tech which was held in the morning, the ceremonies were delayed an hour and a half and were therefore limited to the speech of Prof. A. S. Watts, the speaker of the day. Prof. Watts was introduced by President Brittain who in a few short remarks gave the history of the creation of the department

and told of the help received from the industries of the state. Prof. Watts' speech was interesting and enthusiastically received. President Downs of the Central of Georgia Ry. and Lieut.-Governor Carswell were then called on for a few remarks after which the guests were entertained at luncheon by President Brittain.

After lunch the guests were taken to Grant Field to witness the football game between Tech and Vanderbilt as guests of the Tech faculty. This ended the program.

The new department has a fine building and splendid equipment. The building is one story and basement, built of red brick donated by the Stephenson Co., Birmingham, Ala. It has a white stone trim and a tile roof. The roofing tile were donated by B. Mifflin Hood, Atlanta. All of the rooms and halls are floored with tile and wainscoted with the same material. The tile were also donated by Hood. In the furnace room are two down-draft, gas-fired test kilns and a load furnace. On the same floor is also located the office, a classroom, a library and two laboratory rooms.

In the basement is the heavy equipment consisting of auger machine, cutter, pan, small crushers, clay washing plant, filter press and potters wheel. Taken altogether, Tech has a promising start.

NECROLOGY

Otto W. Will

Otto W. Will

Otto W. Will, Superintendent of the ceramic color department of the Roessler and Hasslacher Chemical Company of Perth Amboy, N. J. and member of the American Ceramic Society since 1919, died on October 30, 1924. Mr. Will was born at Braubach a/Rhein, Dec. 25, 1868 and came to America in 1888. His early education and preparatory work for taking up the medical profession was completed in Germany. In 1891 he took up his work with The Roessler and Hasslacher Co., where he remained until his death. He is survived by his widow, four sons and two brothers.

FURTHER NOTES ON CERAMIC SCHOOLS[1]

North Carolina State College

North Carolina State College which has organized a Department of Ceramic Engineering under the leadership of Prof. Greaves-Walker reports the following class enrollment for this year: 4 Freshmen, 2 Sophomores, 1 Junior and 1 Senior. The Freshmen and Sophomores are registered for Ceramic Engineering and will get their first ceramic work next year. The Juniors will get their degrees in the department in which they originally registered but will take what ceramic courses they can substitute in the Senior year. Two Seniors are getting what ceramics they can by working 12 hours per week on two research problems that are being carried on by the department. This is in addition to their regular senior work. These students are either registered in the department or are taking all of the ceramic work which can be offered this year

[1] See "Notes on Ceramic Schools," *Bull.* **3** [11] 458–60.

preparatory to going into the industry. A description of the correspondence course in ceramic engineering at North Carolina State College follows on page 474.—By Prof. A. F. Greaves-Walker, Head of Department of Ceramic Engineering.

The University of North Dakota

The primary object of the ceramic department of the University of North Dakota is to aid in research work on the high grade clays of the state. For economic and technical reasons this research work was coupled with that of instruction, thereby utilizing the equipment, the laboratories, the technical force and the work of advanced students in both the educational and research problems.

No special degree is given in ceramic engineering, but students in mining and industrial engineering, and in other lines, are given an opportunity to take some of these technical studies as ceramic electives. The work offered in connection with the ceramic department covers two years. The enrollment is limited to sixty which is as many as can be efficiently handled in connection with the research work and present facilities and staff.—By Margaret K. Cable, Asst. Professor of Ceramics.

Newcomb School of Art

	1923–24	1924–25
Total	25	28
Ceramic Decoration	3	11
Making of Pottery and Glaze, Firing	22	17

Seniors: Edith Hohn, Juanita Gonzales Graduate: Elizabeth Davis, Phyllis Reeves.
—By Mary G. Sheerer, Professor of Ceramic Decoration.

NORTH CAROLINA STATE COLLEGE OFFERS CORRESPONDENCE COURSES IN CERAMIC ENGINEERING

New Department of Ceramic Engineering to Pioneer in This Field

In accordance with its purpose to be of the utmost service to the industries of the state and country, North Carolina State College through the College Extension Department has decided to add Ceramic Engineering to its correspondence courses. These courses will carry college credits.

With the knowledge that very little has been done for the growing ceramic industries of the state and that there are a great number of clayworkers in North Carolina and the rest of the country who are desirous of broadening their knowledge of the technical side of ceramics, but have little opportunity to do so, the new Department of Ceramic Engineering, under the direction of Professor A. F. Greaves-Walker, is planning to reach and assist the practical man in every way possible. Realizing that graduates of the department will not be available for four years and will then require practical training before being of any great value to the industries of the state, an Extension program for the clayworker has been laid out which includes a week's instruction in clayworking and ceramics each year and the correspondence courses. These are open to the clayworkers of the entire country.

The correspondence courses to be offered with the credits given are as follows:

1. History of Ceramics (1 credit)
2. Physical Geology (2 credits)
3. Occurrence and Properties of Clays (3 credits)

4. Mining and Preparation of Ceramic Materials (3 credits)
5. Explosives (1 credit)
6. Forming Ceramic Wares (2 credits)
7. Driers and Drying (3 credits)
8. Kilns and Burning (3 credits)
9. Setting Heavy Clay Products (1 credit)
10. Ceramic Calculations (3 credits)
11. Ceramic Designing (3 credits)
12. Feldspars and Kaolins (2 credits)
13. Refractories and Furnaces (2 credits)
14. Pyrometry (1 credit)

As the courses are designed primarily for the present needs of the clayworkers and miners of North Carolina, they will include, for the present, instruction covering heavy clay products only. Other courses may be added later as the need and demand appears.

It is expected that Courses 7, covering Driers and Drying, and 8, covering Kilns and Burning, will be ready in late December or early January. The other courses will be given as a sufficient number of students register for them.

The fees will be based upon the credits given for the completion of each course, two dollars and a half per credit being charged. Thus a three-credit course will carry a fee of seven dollars and fifty cents.

A bulletin describing these courses as well as those offered by other departments of North Carolina State College has been issued and may be had upon application.

NORTH CAROLINA CLAYWORKERS ORGANIZE

At an enthusiastic two-day session held during the week of Nov. 9, 1924, at the Vance Hotel, Statesville, N. C., the clayworkers of the state perfected a permanent organization to be known as the North Carolina Clayworkers Association.

The objects of the Association are educational, the principal ones being: the improvement of plant processes and products, the dissemination of information regarding clay products, and the advancement of the Department of Ceramic Engineering at North Carolina State College.

The officers elected were: President, Frank Daniels, Goldsboro; 1st Vice-President, N. B. Kendrick, Mt. Holly; 2nd Vice-President, J. D. Johnson, Raleigh; Secretary-Treasurer, Prof. A. F. Greaves-Walker, State College, Raleigh; Member Executive Committee, George M. Norwood, Raleigh.

Committees were appointed on freight rates, membership, trade schools, and advancement of Department of Ceramic Engineering, State College.

A committee to act in an advisory capacity to the Department of Ceramic Engineering, composed of Frank R. Daniels, T. H. Holmes, and George M. Norwood, was also appointed.

Prof. Greaves-Walker made a preliminary report on the clay, shale and kaolin resources of the state and predicted an era of ceramic development in the Piedmont region in the immediate future. He also announced that State College would offer a short course in Clayworking and Ceramics, January 12–16, 1925, and was now offering correspondence courses in fourteen ceramic engineering subjects. This is the first time ceramic engineering subjects have ever been offered by correspondence.

Theodore A. Randall, for thirty-nine years Secretary of the National Brickmakers

Association, with headquarters at Indianapolis, Ind., was among the guests at the convention.

The next quarterly meeting of the Association will be held in Raleigh, during the week of January 12, 1925.

SHORT COURSE IN CERAMICS AT NEWELL, W. VA.

The second year of ceramic instruction at the Newell High School was begun with the initial session held on Thursday, November 6. The classes as before are arranged for Monday and Thursday, from 7.30 till 9 P.M. The work has made a good beginning with 40 registered students.

The courses given are as follows: Shop Arithmetic and Shop Mechanics, by R. V. Miller; Principles of Ceramics and Ceramic Problems, by J. W. Hepplewhite; Heat and Heat Measurement, by V. J. Roehm; Principles of Economics, by Lester M. Aaron. The instructors are all connected with potteries of this district. Mr. Miller is ceramic chemist with the Knowles, Taylor and Knowles Pottery Co. of East Liverpool, Mr. Hepplewhite is with the E. M. Knowles China Co. of Newell, Mr. Roehm with plant No. 6 of the Homer Laughlin China Co. and Mr. Aaron with plant No. 4 of the same company. With the exception of the last named instructor these men are graduates of Ohio State University. Mr. Aaron is a graduate of Princeton and Harvard.

Much credit is due these men for the work they are doing which involves considerable sacrifice in time and labor. It is a most encouraging sign, however, that the course has the earnest support of the Brotherhood of Operative Potters. The duration of the course is 18 weeks.

EXHIBITS OF CLAY WORKING MACHINERY

The Common Brick Manufacturers Association is providing opportunity in connection with their annual meeting, Drake Hotel, Chicago, February 9–13 for an exhibit of clayworking machinery and supplies. This is the week prior to the Annual Meeting of the American Ceramic Society in celebration of the world's first collegiate department of ceramic engineering, Columbus, Ohio. There is coöperation between these two organizations to make these exhibits educational in the most effective way.

SOCIETY OF GLASS TECHNOLOGY

The first meeting of the Society of Glass Technology for the session 1924–25 was held in Sheffield on October 15, the President, Col. S. C. Halse, in the chair. An address entitled, "The Present Position of the Glass Industry in North America," was given by W. E. S. Turner, who observed that in America the period of trade depression had not been continuous, as was the case in the United Kingdom. In the autumn of 1922, American trade began to improve, and 1923 was a very good year. In February, 1922, trade in general began to fall off, and a very dull period still persisted.

The cut glass industry had almost entirely died out in America, but colored glass was finding a place more and more. There was a distinct improvement in American taste for glassware. At the Steuben works of the Corning Glass Company some very fine artistic work was being manufactured.

Prof. Turner next referred to the gradual disappearance of pot furnaces in favor of tank furnaces. The latter were now being used even for the manufacture of green and

blue signal lights, and for selenium ruby glass. Electric light bulbs, except in the case of very small or very large bulbs, were now practically all made by machines fed from tank furnaces, the glass being the soda-lime-magnesia type. The tubing required for the completion of the lamp was still of the glass variety.

Several noteworthy advances in the glass industry were then noted. During the past few years there had been a very distinct development in the use of blowing machines or press and blow machines. In this connection reference was made to (1) the Westlake Machine for thin walled tumblers, (2) The Hartford-Empire Machine for electric light bulbs, and (3) the great development in the manufacture of light walled tumblers.

Dealing next with sheet glass, Prof. Turner remarked that the Fourcault process had not as yet achieved any considerable success in America. The cylinder process was still in active operation. An epoch-making operation was that developed at the glass works of the Ford Motor Company. This process marked an absolute departure of the use of pot furnace, as the glass was melted in tanks and there was continuous rolling between a pair of rollers, the sheet passing down a leer about 440 feet long and subsequently, in sheets, traversed long tables in a continuous belt, where the grinding and polishing were done.

With regard to bottle machine there was a tendency to replace the Owens machine in favor of the feeder-fed type. There were no striking advances in feeding devices, the Hartford-Empire Feeder being the most in favor, followed by the W. J. Miller. One novelty in operation was the use of a rotating plunger, especially when large ware was being made.

Prof. Turner then dealt with the problems of furnaces and furnace efficiency. This was one of the foremost problems discussed by glass manufacturers. The average life of a tank furnace operated by machines was 11 to 13 months. A table was presented showing for a number of factories the value of the ratio of fuel consumed to glass melted. Several factories could show a ratio as low as 0.6. In conclusion reference was made to the innovation of the use of heatless leers. A description was given of such leers.

BUREAU OF MINES NOTES

Dolomite for Refractories

The dolomite refractories investigation being conducted by the Department of the Interior at the Ceramic Experiment Station of the Bureau of Mines, Columbus, Ohio, includes a study of the many fluxes which could be used to aid in the dead-burning of dolomite and also a complete survey of the iron oxide-alumina-silica field as fluxes. The temperature of calcination and the resulting properties have been carefully investigated, and the most desirable calcines chosen for further investigation in the making of dolomite brick. Many binders and the several methods in common use of fabricating brick commercially have been tried, and a thorough study has been made of the properties of the most successful ware.

The results of the work of the Bureau of Mines investigators indicate that by employing the proper fluxes in the proper proportions, it is possible to dead-burn dolomite, when properly sized and under proper heat treatment, to a grain that will not slake after long exposure to the air or under the more severe autoclave treatment. Several binders for the ground grains have been found to give promise while two of this number are especially satisfactory. It is possible to make shapes from ground sinter, by both the semi-dry press and slop mold methods, which, when properly fired, will not slake upon prolonged exposure to the weather. The brick thus made have physical properties which indicate that they will probably give good service as a basic refractory.

Details of these investigations looking toward the utilization of dolomite for refractories are given in Serial 2627 by G. A. Bole, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

NOTES FROM THE BUREAU OF STANDARDS

The Strength of Hollow Tile and Reinforced Concrete Floor Slabs

The Bureau of Standards, in coöperation with the Hollow Building Tile Association, recently completed a series of tests on specimens of combination hollow tile and reinforced concrete floor slabs. reinforced in but one direction. The tests were planned to determine the extent to which the tile could be relied upon in resisting bending and shearing stresses.

Forty-four slabs, varying from 8 ft. 10 in. to 15 ft. in length, with a total depth of 8 in., and a maximum width of 30 in. were tested. The combination slabs consisted of two 4-in. concrete ribs separated by a single row of tile, laid with their cells parallel to the length of the slabs, and enclosed on each side by a row of tile sections which had been cut to include nearly one-half their original width. In some of these slabs 8 by 12 in. tile were used without a topping, and in others 6 by 12 by 12 in. tile were laid and covered by a 2 in. concrete topping. For comparison 2 in. solid concrete slabs having the same gross sectional area as the composite slabs, and 3 in. solid concrete beams having the same sectional area as the area of the concrete ribs in the composite slabs were tested. A greater amount of tensile reinforcement was used than is ordinarily employed in practice in order to prevent the failure of the steel before high stresses in the concrete and tile had been developed.

The specimens were tested in a vertical-screw beam-testing machine having a capacity of 600,000 pounds. The deformations in the concrete, tile and steel, and the deflections of the slabs were measured as the loads were applied. By changing the positions of the loads, bending and shearing stresses several times greater than working stresses for concrete were developed.

It was found that the bond between the concrete and tile was sufficient to cause the tile to assist materially in resisting both bending and shearing stresses. The value of the tile in beams without a concrete topping was almost directly proportional to the modulus of elasticity of the tile. When medium or hard tile are used, it appears that the shells of the tile which are in contact with the concrete are as effective as an equal width of concrete would be. A report on these tests is now being prepared for publication.

Method for Evaluating the Different Qualities of Clays

The elementary chemical analyses of all clays show the same constituents, but in widely varying proportions. These differences have failed to account for variations in color (raw and fired), working properties, plasticity, absorption, adhesiveness, and refractoriness.

The Bureau of Standards has undertaken the study of clay colloids, into which a part of all the ultimate elements of the clay body enter, by subjecting a standard, commercial, washed white paper and pottery clay, long known for relative uniformity in its properties, to the action of leaching and dispersion with water and dilute reagents to which it may be subjected in its various uses. It has been separated into fractions of relatively greater and less concentration of absorbed basic elements, and into fractions of greater and less colloid content, and of coarser and finer granular composition.

These divisions are to be subjected to all practical tests capable of quantitative evaluation in comparison with the original. It is believed that by a comparative study of the clay with its own definitely controlled modifications and derivatives, increasing and decreasing its plasticity, supsension power, absorption, color and fire behavior, information will be obtained that will be applicable to all other clays and which will lead to new analytical methods for evaluating the different qualities of clays.

Drying Properties of Clays

The Bureau's preliminary work on the investigation of the drying properties of clays has been completed and a report which will include a discussion of the factors affecting the satisfactory drying of clay wares is now being prepared for publication. Lovejoy's classification of clays is used approximately, and successful drying is shown to be a function of the character of the clay and of the rate of drying, involving as factors temperature and humidity of both air and clay, and also size and shape of the clay body. The causes of the various types of drying injuries are also pointed out.

As a result of observations made, the following method is suggested for working out a rapid and safe drying schedule for each type of clay: Successive groups of samples of the particular type of clay under consideration are dried, each group at a rate more rapid than that used in the preceding group. This is continued until the most rapid possible drying rate has been determined, beyond which rate any increase in the temperature or rate of drying results in an excessive and intolerably large percentage of drying injuries to the ware.

Frequent observations of shrinkage during such trials have shown: First, that cessation of drying shrinkage takes place comparatively early in the drying process, and is practically coincident with the completion of the evaporation of the so-called "free water;" second, that after this stage is reached, the drying may be hastened almost as much as desired, so long as baking temperatures are not reached, without appreciably adding to the percentage of drying injuries.

New Method for Bonding Magnesia Refractories

The Bureau's preliminary work with magnesia refractories has indicated a promising method of bonding electrically fused magnesia which will be used in making the first experimental lining for the Bureau's new Detroit electric furnace for steel melting. Eighty-mesh fused magnesia bonded with approximately 20% water-ground fused magnesia burns at 1500 to 1600°C to a satisfactory strength and if properly applied may be used as a firmly adhering facing over commercial magnesite brick.

Ground Coat and White Cover Enamels for Sheet Iron and Steel

An investigation of the relative values of feldspar and quartz as the refractory in white cover enamels for sheet iron and steel has recently been completed. This work was undertaken to determine the effect produced by substituting feldspar for quartz, and quartz for feldspar in commercial types of enamels.

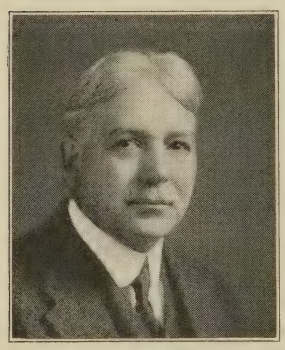
The report on the work which is being prepared for publication will contain the results obtained with three groups of twenty enamels each, in which feldspar-quartz ratios were 60:0, 35:25, and 0:60, the other constituents being changed in quantity and kind. The results indicated in general that: First, increasing the quartz reduced opacity of the enamels, increased their resistance to thermal shock and to action of acid, but produced no marked change in their mechanical strength; second, the effects of increasing the feldspar were not as pronounced as in the former case, but it may be said that a slight decrease in opacity, resistance to acid and thermal shock, and mechanical strength was obtained.

JOHN L. HARPER, THE ENGINEERING GENIUS OF NIAGARA FALLS POWER COMPANY, CALLED BY DEATH

John Lyell Harper, vice-president and chief engineer of the Niagara Falls Power Company, died November 28th. He underwent an operation for appendicitis, but his heart was unable to withstand the rigors of the malady.

An Engineering Genius.—Recognized as one of the greatest of the world's hydro-electric engineering geniuses, Mr. Harper was responsible to a large extent for the development of the Niagara Falls Power Co. He was associated with that concern and its predecessor, the Hydraulic Power & Manufacturing Co., for 22 years, starting in the company's employ as an assistant engineer. He designed and constructed the eleven million dollar extension of the company's mammoth plant which was completed recently and which will remain a monument to his ability as a hydro-electric genius. He also designed other big development works of the company.

Mr. Harper was 51 years old, having been born in Harpersfield, Delaware county, New York, September 21, 1873. He was vice-president and chief engineer of the Harper-Taylor Company, consulting engineers recently organized and in which the Cramps Shipbuilding Company is heavily interested.



J. L. Harper

Mr. Harper was prominently identified in the membership of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Electrochemical Society, the American Ceramic Society and the Engineers' Club of New York City.

Four years at Cornell University brought his degree in Mechanical Engineering and in 1898, one year after graduation, he married. His career was marked by the simple progression that stamps the lives of all mortals who achieve the real things in life. He was in charge of the design and of the construction of Hydraulic Station No. 3-A in the gorge below the Falls. In the long stretch of years from 1902 until 1918 under his engineering direction the installed capacity of the great gorge plants grew from 14,000 to 160,000 horse power. During the year 1918 the various power interests were grouped under government direction into a new corporation taking the name of the Niagara Falls Power Company, and Mr. Harper was made its chief engineer.

During the war when there was a serious shortage of power at Niagara Falls and the War Department requested plans for the most economical development to utilize the remaining water available for diversion, it was the Harper plan that met with the approval of the government.

It has been said, and rightly too, that genius is the capacity for taking infinite pains. Such a one was John Lyell Harper. His imagination and his foresight were astonishing. He seemed always to be ready when the time of action came. It is some slight consolation to those who shared his labors that he saw the completion of the latest power plants for they are the children of his mastermind.

CALENDAR OF CONVENTIONS

Organization	Date	Place
AMERICAN CERAMIC SOCIETY (Annual Meeting)	Feb. 16–21, 1925	Columbus, Ohio
Am. Assn. Adv. of Science	Dec. 29, 1924–Jan. 3, 1925	Washington, D. C.
Am. Assn. of Flint and Lime Glass Mfrs. (Annual Meeting)	July, 1925	Atlantic City, N. J.
Am. Soc. for Testing Materials	June 22–26	Atlantic City, N. J.
Am. Concrete Institute	Feb. 24–27, 1925	Chicago, Ill.
Am. Face Brick Assn.	Dec. 2–4, 1924	Hot Springs, Va.
The American Institute	Dec., 1924	New York City
Am. Inst. of Chemical Engrs.	Dec. 3–6, 1924	Pittsburgh, Pa.
Am. Society of Mech. Engrs.	Dec. 1–4, 1924	New York City
Common Brick Mfrs. Assn.	Feb. 9–13, 1925	Chicago, Ill.
Eastern Paving Brick Mfrs. Assn.	Dec., 1924	New York (?)
Exposition of Inventions	Dec. 8–13, 1924	New York City
Hollow Bldg. Tile Assn.	Jan., 1925	Chicago, Ill.
Manufacturing Chemists' Assn.	June, 1925	New York City
Mining & Met. Society of America	Jan. 13, 1925	New York City
Natl. Assn. of Mfrs.	May, 1925	New York City
Natl. Assn. of Mfrs. of Pressed and Blown Glassware	March, 1925	Pittsburgh, Pa.
Natl. Assn. of Stove Mfrs.	May 13–14, 1925	New York City
Natl. Brick Mfrs. Assn.	Jan. 26–31	Washington, D. C.
Natl. Clay Products Industries Assn.	April, 1925	Chicago, Ill.
Natl. Exposition of Power & Mech. Engrs.	Dec. 1–6, 1924	New York City
Natl. Glass Distributors' Assn.	Dec., 1924	Pittsburgh, Pa.
National Lime Association	May, 1925 (?)	
N. J. Clayworkers' Assn. and E. Sec. of the AMERICAN CERAMIC SOCIETY	Dec. 19, 1924	New Brunswick, N. J.
Taylor Society	Dec. 4–6, 1924	New York City
Tenth Exposition of Chem. Industries	Sept. 28–Oct. 3, 1925	New York City
Tile & Mantel Contractors' Assn. of America	Feb. 9, 1925	Louisville, Ky.
U. S. Potters' Assn.	Dec., 1924	Washington, D. C. (?)
Western Paving Brick Mfrs. Assn.	Jan., 1925	Kansas City, Mo.

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[1] Star indicates member is active. All other members are associate. The initial following the name indicates the Division to which the member belongs as follows: (A), Art; (E), Enamel; (G), Glass; (H. C. P.), Heavy Clay Products; (R), Refractories; (T. C.), Terra Cotta; (W. W.), White Wares. No initial following the name indicates that the member is unclassified.

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Gustave Glocker, North East Porcelain Co., North East, Md.—W. W.
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H. Goulding-Brown, 28 Titchborne St., Hyde Park, London, W. 2, England.
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R. F. Grady, 5811 Manchester Ave., St. Louis, Mo.
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C. V. Grafton,* Muncie Clay Products Co., Muncie, Ind.—A.
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Russel J. Grainer,* 211 Mill St., Beaver Dam, Wis.—E.
De Forrest Grant,* 101 Park Ave., New York City.—T. C.
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John N. Gregori,* Northwestern Terra Cotta Co., Chicago, Ill.—T. C.
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M. E. Gregory,* Corning Brick Terra Cotta & Tile Co., Corning, N. Y.—T. C.
Carl H. Griffin,* Norton Co., Wesseling Bei Koeln, Germany.—R.
Paul F. Griffin, U. S. Refractories Corp., Mount Union, Pa.—R.
R. E. Griffith,* 670 Bullitt Bldg., Philadelphia, Pa.—R.
Norman Griffiths, c/o Eureka T. C. & Tile Co., Ballarat Victoria, Australia.—T. C.
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Rafael Guastavino, Jr.,* 1133 Broadway, Madison Sq. Station, New York City.—W. W.
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George Haaf,* 126 Franklin Ave., Solvay, N. Y.—W. W.
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H. N. Haberstroh,* 53 W. Jackson Blvd., Chicago, Ill.—R.
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John S. Halbert,* 7409 N. Ashland Blvd., Chicago, Ill.
Virgil K. Haldeman, 318—13th St., Beaver Falls, Pa.—W. W.
Mark A. Haley,* 854 Maryland Ave., Syracuse, N. Y.—W. W.
Larence A. Hall,* 7951 Winston Rd., Chestnut Hill, Philadelphia, Pa.
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Karl Hart, 111 N. Rugby Ave., Huntington Park, Calif.—R.
Frank M. Hartford,* 419 Majestic Bldg., Columbus, Ohio.—H. C. P.
Miner L. Hartmann,* 3006 McKoon Ave., Niagara Falls, N. Y.—R.
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A. G. Johnson, 116 Hyland Ave., Ames, Iowa.
Fred P. Johnson,* 235 W. Ave. 26, Los Angeles, Calif.—H. C. P.
G. A. Johnson, 612 W. Main St., Maryville, Tenn.
Oscar H. Johnson, c/o Mine & Smelter Supply Co., Denver, Colo.
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Edgar Jones,* 35 Rimbach Ave., Hammond, Ind.—W. W.
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R. M. King,* 72—14th Ave., Columbus, Ohio.—R.
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Anthony M. Kohler,* The B. & W. Co., 85 Liberty St., New York City.—R.
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S. Kondo,* Tokio Higher Technical School, Asakusa, Tokio, Japan.
E. K. Koos,* Chelsea China Co., New Cumberland, W. Va.—W. W.
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I. Koyama,* Technical College Keijo, Korea, Japan.
Oscar W. Kraft,* 3350 Scotten Ave., Detroit, Mich.—E.
J. B. Krak,* 42 Hammond St., Jamaica, N. Y.—G.
Hobart M. Kraner,* Illinois Electric Porcelain Co., Macomb, Ill.—W. W.
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Ellis L. Krause,* 218 Fifth St., Marietta, Ohio.—R.
George Krause,* R. F. D. 1, Zanesville, Ohio.
Charles C. Krausse, Cons. G. E. L. & P. Co., Lexington Bldg., Baltimore, Md.
A. E. Krebs,* Belleville Enam. Works, South 16th St., Belleville, Ill.—E.
John M. Kreger,* c/o Woodbridge Ceramic Corp., Woodbridge, N. J.—W. W.
J. F. Krehbiel,* 1538 N. High St., Columbus, Ohio.—W. W.
Henry R. Kreitzer,* 277 Hawthorne Ave., Portland, Oregon.—H. C. P.
Albert Krekel,* 2803 Chelsea Terrace, Baltimore, Md.—E.
W. E. Kreutzer,* 4624 Cliff Ave., Highland Park Sta., Louisville, Ky.—R.
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Thos. N. Kurtz,* 507 Iroquois Apts., Pittsburgh, Pa.—R.
Cyril Kussman,* c/o Favorite Stove & Range Co., Piqua, Ohio.—E.

Mattie Lee Lacy,* College of Industrial Arts, Denton, Texas.—A.
Roy Lacy, 634 S. St. Andrews Pl., Los Angeles, Calif.—H. C. P.
Raymond B. Ladoo,* Southern Minerals Corp., 342 Madison Ave., New York, N. Y.—W. W.
John A. Lahey,* Sewaren, N. J.—R.
Josef Lahovsky, Horni Briza u Plzne, Czechoslovakia.
Charles Laird,* 102 Lake St., Ashtabula, Ohio.—H. C. P.
Clinton N. Laird,* Canton Christian College, Canton, China.
J. S. Laird,* 25 Francis St., Dearborn, Mich.—W. W.
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ABBREVIATIONS USED IN INDEX

abs.	absolute
a. c.	alternating current
alk.	alkaline
amt.	amount
anal.	analysis
app.	apparatus
approx.	approximate, approximately
at. wt.	atomic weight
av.	average
b. p.	boiling point
B. t. u.	British thermal units
bldg.	building
Brit.	British
cal.	calory(ies)
calc.	calculate
calcd.	calculated
calcg.	calculating
calcn.	calculation
Can.	Canada
cc.	cubic centimeters
ceram.	ceramics
charac.	characteristics
chem.	chemical (not chemistry)
cm.	centimeter(s)
circ.	circular
Co.	Company
Comm.	Committee
coeff.	coefficient
compd.	compound
compn.	composition
concd.	concentrated
concn.	concentration
condy.	conductivity
const.	constant
contd.	contained
contg.	containing
c. p.	chemically pure
cryst.	crystalline (not crystallize)
crystd.	crystallized
cu. m.	cubic meter(s)
d.	density
d. c.	direct current
decompn.	decomposition
det.	determine
detd.	determined
detg.	determining
detn.	determination
dil.	dilute
econ.	economical
ed.	educational
elec.	electric, electrical
e. m. f.	electromotive force
equil.	equilibrium
equiv.	equivalent
est.	estimate
estd.	estimated
estg.	estimating
estn.	estimation
evap.	evaporate
evapd.	evaporated
evapg.	evaporating
evapn.	evaporation
examd.	examined
examg.	examining
examn.	examination
expt.	experiment
exptl.	experimental
ext.	extract
extd.	extracted
extg.	extracting
extn.	extraction
f. p.	freezing point
ft.	foot, feet
fund.	fundamental
fur.	furnace
gen.	general
g.	gram(s)
htg.	heating
h. p.	horsepower
hr.	hour
in.	inch(es)
indus.	industrial
inorg.	inorganic
insol.	insoluble
invest.	investigation
kg.	kilogram(s)
kw.	kilowatt(s)
l.	liter(s)
lab.	laboratory
lb.	pound(s)
lit.	literature

mach.	machinery, machine
mat.	material
m.	meter(s)
manuf.	manufacture
max.	maximum
mfg.	manufacturing
meas.	measure, measurement
mech.	mechanical
mg.	milligram
min.	minute(s)
mixt.	mixture
mol.	molecule, molecular
mol. wt.	molecular weight
m. p.	melting point
N	normal
org.	organic
oper.	operate
operg.	operating
opern.	operation
p. d.	potential difference
phys.	physical
physiol.	physiological
Port.	Portland
powd.	powdered
prac.	practical
ppt.	precipitate
pptd.	precipitated
pptg.	precipitating
pptn.	precipitation
prep.	prepare
prepd.	prepared
prepg.	preparing
prepn.	preparation
press.	pressure
prob.	problem
qual.	qualitative
quant.	quantitative
ref.	reference
refrac.	refractory
rept.	report
resis.	resisting
resist.	resistance
resp.	respectively
r. p. m.	revolutions per minute
sat.	saturate
satd.	saturated
satg.	saturating
satn.	saturation
scien.	scientifically, scientific
sec.	second(s)
sep.	separate
sepd.	separated
sepg.	separating
sepn.	separation
sol.	soluble
soln.	solution
soly.	solubility
sp.	specific
sp. gr.	specific gravity
specif.	specifications
sq. cm.	square centimeter(s)
stand.	standard
subs.	substance
temp.	temperature
tent.	tentative
v.	volt(s)
vol.	volume (not volatile)
wt.	weight

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Abstractors: Olaf Andersen, Robert J. Anderson, A. A. Ayars, C. E. Bales, E. N. Bunting, W. M. Clark, S. S. Cole, R. R. Danielson, F. C. Flint, H. D. Foster, A. F. Gorton, Perry D. Helser, C. J. Hudson, W. R. Kerr, P. W. Ketchum, S. Kondo, H. F. Kriege, B. M. Larsen, R. D. Leitch, J. T. Littleton, Jr., M. E. Manson, T. N. McVay, R. J. Montgomery, Louis Navias, O. P. R. Ogilvie, C. W. Owings, C. W. Parmelee, J. G. Phillips, W. E. Rice, E. Schramm, H. G. Schurecht, D. E. Sharp, H. F. Staley, H. H. Stephenson, F. A. Whitaker.

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